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ERRATA.

Page 235, line 13, for **akleyorum** read **akeleyorum**.
" " " 19, " **akleyorum** " **akeleyorum**.
" 359, " 29, " **Stenolæmus** read **Stenotæmus**.
" 375, " 13, " **Chilorsiac hrysochlamys** read **Chilorsia chrysochlamys**.
Plates XXIII and XIV, for AKLEYORUM read AKELEYORUM.

BULLETIN

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Article I.—HISTORICAL AND NOMENCLATORIAL NOTES ON NORTH AMERICAN SHEEP.

BY J. A. ALLEN.

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INTRODUCTION.

The present paper originated in an attempt to settle the question of priority between the names *Ovis cervina* Desmarest and *Ovis canadensis* Shaw, both of which prove to have been published early in the year 1804. This investigation led to the finding of many interesting facts connected with the original discovery of the Rocky Mountain Bighorn and the origin of its early technical names, and also other information relating to the discovery of other forms of North American sheep. While little of the early information here cited is new, much of it has been lost sight of in recent years; nor has it ever been presented fully or connectedly. For this reason the McGillivray account is here treated with a fullness of detail that may seem unnecessary, notwithstanding its historic interest, and the fact that it is the sole basis of the three technical names most frequently employed for the designation of the Rocky Mountain Bighorn. Attention is called, also, to various misstatements that have crept into the literature of the general subject, and to the diverse figures based on the original drawing of the type specimen. These show how untrustworthy zoölogical illustrations may be, and how easy it is to place too much reliance on pictorial representations of animals in even standard works.

Finally it has seemed desirable to conclude this paper with a list of the numerous forms of American sheep at present currently recognized, with their synonymy, type localities, geographical distribution, and principal references.

DISCOVERY OF WILD SHEEP IN CANADA IN THE YEAR 1800 BY DUNCAN McGILLIVRAY.

The accounts of the discovery and the early descriptions of the Rocky Mountain Sheep are of such interest as to be worthy of consideration in some detail, especially since a question of nomenclature rests on the correct determination of the dates of publication of different accounts based on the original McGillivray specimen.

The first specimen of this sheep known to science was killed and preserved by Duncan McGillivray, an agent of the North West Fur Company,[1] who accompanied the well known explorer and surveyor, David Thompson, while making his survey of the upper Bow River country of Canada in the autumn of 1800. McGillivray has left on record definite information as to the time and place of its capture, and a first hand account [1] of the habits, haunts, and external characters of this now well known species. It appears from his narrative that these two explorers first met with these animals on November 30, 1800, near what is now Calgary in southern Alberta, where the Bow River emerges from the first range of the Rocky Mountains, in, as McGillivray states, longitude 115° 30′ west, and latitude 50° north.[2] They found here a small band and killed a number of them, including a fine old ram. He recognized the animal as a nondescript, and preserved the skin of the ram to send to the Royal Society of London.

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[1] "Duncan McGillivray was a clerk of the North West Co., in 1797 or earlier," says Dr. Coues, and "accompanied David Thompson on his Bow River tour, Nov. 17th–Dec. 3d, 1800. He left the N. W. country in 1802, became a partner of McTavish, Frobisher & Co., and was one of the signers of the Montreal agreement of Nov. 5th, 1804."— New Light on the Early History of the Greater Northwest: The Manuscript Journals of Alexander Henry and of David Thompson, I, 1897, p. 439, footnote.

His account [3] begins as follows: "In the fall of 1800, I was on an excursion on horseback, through the plains that are situated between the Sascatchevan and Missouri rivers, along the rocky mountains, accompanied by Mr. Thompson, a Gentleman of the N. W. Company's employ, five Canadians, and an Indian guide. Returning back to the north, we followed the course of the Bow-River, into the heart of the mountains, with a view of examining them — and on the 30th November, at noon, we halted at the foot of the first ridge to graze our horses, and ascertain our latitude. At a little distance ahead, appeared a herd of small animals, which we took to be a species of the Deer, in that country very numerous. While Mr. Thompson was taking his meridian altitude, I went forward with the Indian to have a shot, and on a nearer approach, was very much surprised to find (instead of Deer) a herd of about twenty animals, that were utterly unknown to me." He describes how he and the Indian killed five, and adds: "I had the satisfaction to shoot a large male, whose motions appeared to guide the flight of the rest — his superior size, and enormous horns, made him the particular object of my pursuit, and I have preserved his skin, with a view of presenting it to the Royal Society of London. During the Winter, I had frequent opportunities of hunting this tribe, which has enabled me to make a few observations on it, that may be of advantage to Naturalists, in ascertaining the genus, or species of this animal. The dimensions of the above male, taken on the spot, where he was killed, namely, longitude 115. 30, West, and latitude 50. North, are as follows:. . . ." He describes the hair and horns, and says: ". . . .in short, this animal appears to be a compound of the deer and the sheep, having the body and hair of the former, with the head and horns of the latter." Later, after speaking of its habits and its range, he describes the female, and says "they are all [both males and females] distinguished by the white rump and black tail," but he nowhere makes any reference to the general coloration.

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[1] New York Daily Advertiser, Vol. XVIII, No. 5561, December 4, 1802; New York Medical Repository, Vol. VI, 1803, pp. 238–240.

[2] Latitude 50° N., is evidently wrong, as David Thompson's map of the Bow River country (see maps accompanying Coues's 'New Light on the early History of the Greater Northwest') shows the Bow River emerging from the first range of the mountains at about latitude 51° 20′, as on modern maps, and hence near Calgary.

[3] In the New York Daily Advertiser, *l. c.*

"The Crees, or Knistianeaux," he continues, "distinguish this animal by the name MY-ATTIC, or the *Ugly Rein Deer.* The Slave Nations, comprehending *Blood Indians, Piecans,* and *Black Feet* Indians, call it EMA-KI-CA-NOW, which also means a species of the Deer — but the Canadians who accompanied me, at first sight, named it *le belier des montagnes* (the mountain Ram). It is only to be met with in the rocky mountains, and it generally frequents the highest regions, which produce any vegetation, though sometimes it descends to feed to the bottom of the valleys.... The Mountain-Ram, or Sheep, though not numerous, are to be met with in considerable numbers in some parts of the mountains, from latitude 54 southward. I have, on several occasions, seen herds of 20 or 30, but generally not more than 2 or 3 of them together."

MCGILLIVRAY'S ACCOUNT, AND SAVAGE'S DRAWING OF THE ORIGINAL SPECIMEN.

Mr. McGillivray was in New York late in the year 1802, with his nondescript mountain ram, which was for a short time in a private museum and art gallery in that city, owned by an artist named E. Savage, before it was sent to London. To Mr. Savage great credit is due, as will be soon shown, for his part in making known to the world McGillivray's discovery, as he not only made a careful drawing of the specimen, but induced McGillivray to prepare an account of his discovery of this new species, with his observations on its habits and external appearance, and also secured the prompt publication of both his own drawing and Mr. McGillivray's narration. Thus, the 'Daily Advertiser' article is introduced by a letter to the editor from Mr. Savage, which reads as follows:

> "Having been informed that Mr. D. McGillevray, a Gentleman from Canada, had in his possession, the Skin of a non-descript animal, I made application to him for leave to make a drawing of it, to enrich the Columbian Gallery. He very politely indulged my request and at my solicitation has favored me with the following account, which elucidates the drawing, and which may gratify the public curiosity. E. SAVAGE."[1]

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[1] The Daily Advertiser, New York, Vol. XVIII, No. 5561, Saturday, December 4, 1802. The article is entitled 'Description of the My-Attic, or Mountain-Ram,' and makes a full column, and a few lines on the next, of the large folio page, and is printed as a single paragraph. The sentences are frequently separated only by a dash, and the sentence following the dash sometimes begins with a capital letter and sometimes with a lower case initial. There is a profuse use of commas, but in other respects the article is intelligently written and has the appearance of having been printed as the author wrote it.

Before Mr. McGillivray's article was sent to the 'Daily Advertiser,' a manuscript copy of it had been communicated to Dr. Samuel Latham Mitchill, one of the editors of the New York 'Medical Repository,'[1] by this same Mr. Savage, in a letter dated Nov. 24, 1802. It was published in the 'Repository,' probably in the following January,[2] in an article entitled 'Account of the Wild North American Sheep.' This article consists of an editorial introduction to a communication bearing the following explanatory caption: "Memorandum respecting the Mountain Ram of North America. By Duncan McGillivray. Communicated to Dr. Mitchill, by Mr. Savage, in a Letter, dated New York, November 24, 1802."

Dr. Mitchill states in his editorial introduction (*l. c.*, p. 237): "It is not universally known that there are species of sheep running wild in the woods of North America. This, however, is the fact; and a dried specimen of one of them was lately brought to New-York by Mr. M'^{c}Gillivray. It was made known to Dr. Mitchill by Mr. Savage, and is now in his Museum. That enterprising artist has made two good paintings from it...." The uncolored plate in the 'Medical Repository' (facing p. 237) is of course from one of them. As will be shown later, the other soon found its way to Paris, and "the dried specimen" was, apparently, soon after received at the British Museum.

Mr. McGillivray's account of the animal in the 'Daily Advertiser' was republished in London in the 'European Magazine and London Review' for 1803, under the title 'Description of the My-Attic, or Mountain Ram,' and credited to the 'New York Daily Advertiser.' From this source it was again republished, one hundred and seven years later, in New York,

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[1] The Medical Repository, and Review of American Publications on Medicine, Surgery, and the Auxiliary Branches of Science. Conducted by Samuel Latham Mitchill, M. D., and Edward Miller, M. D. Vol. VI, No. III, (Jan.?) 1803, pp. 237–240, with a plate.

The manuscript sent to the editors of the 'Medical Repository' was probably a duplicate copy of that published in the 'Daily Advertiser,' but subjected before printing to considerable editorial revision. The paragraphing and the construction of the sentences vary much from the London magazine version, and in the use of capitals and punctuation it further widely differs from the 'Advertiser' article. There are also a few verbal changes, and the omission here and there of words or phrases essential to the integrity of the original text. In substance, however, the 'Medical Repository' version is the same as the article in the 'Advertiser.' This is fortunate, since the 'Medical Repository' is the source from which, with perhaps a single exception (Geoffroy), the McGillivray account has been uniformly cited or made use of by all later writers prior to 1910.

[2] As bound up the separate numbers carry no date, nor is a date indicated for them in the table of contents, but there is evidence in the dates carried by some of the communications to show that the four quarterly numbers composing the volume were issued for July, October, January, and April, 1802–1803, as was the case in the later volumes, in which the numbers are dated.

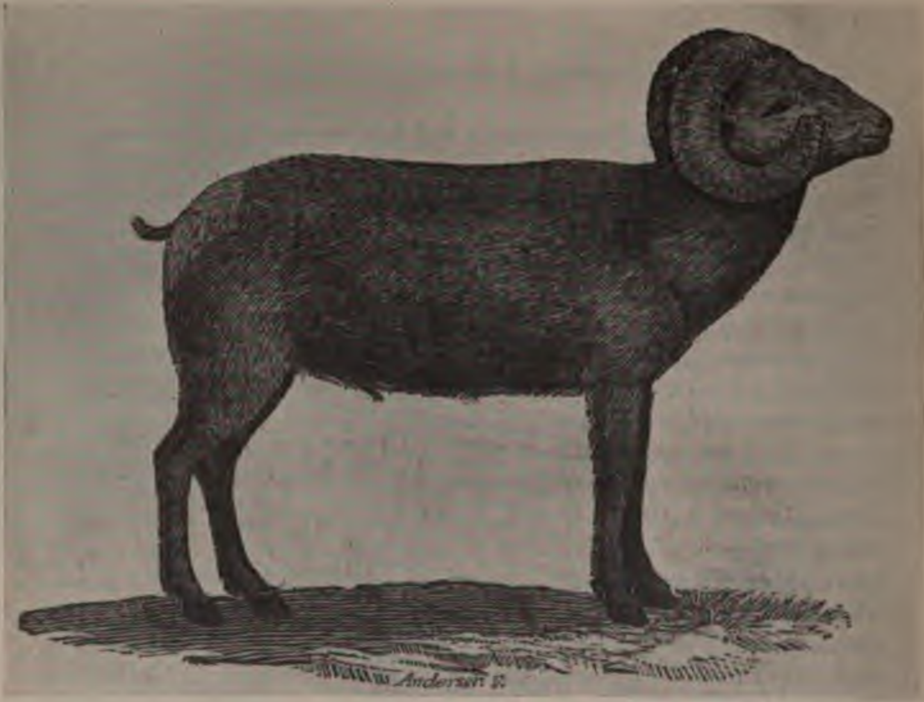
Anderson sc.

Fig. 1. From drawing by E. Savage. New York Med. Reposit., Vol. VI, 1802–03, pl. facing p. 237.

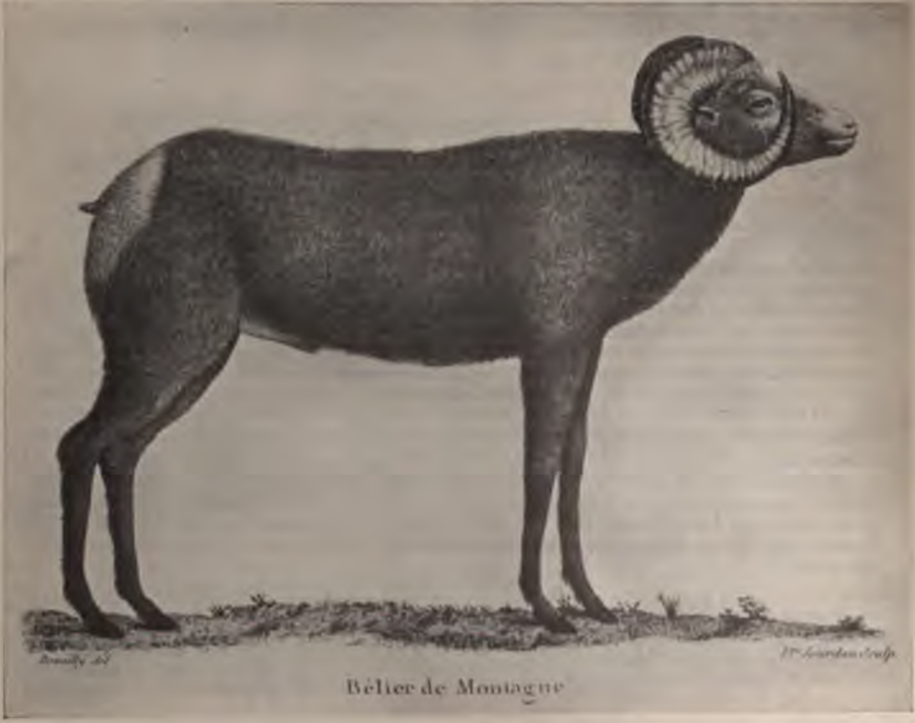

Fig. 2. From drawing by E. Savage. From Ann. du Mus. d'Hist. Nat., Vol. II, 1803, pl. lx.

in the issue of 'Forest and Stream' for October 29, 1910.[1] It was this republication that gave me a clue to the source whence the Rocky Mountain Sheep was originally introduced into technical zoölogical literature, for immediately I recalled the fact that Mr. Savage's drawing and Mr. McGillivray's account as published in a New York newspaper formed the basis of Geoffroy's original description and figure of his 'Belier de Montagne,' in 1803, which became the basis of Desmarest's name *Ovis cervina* early in 1804.

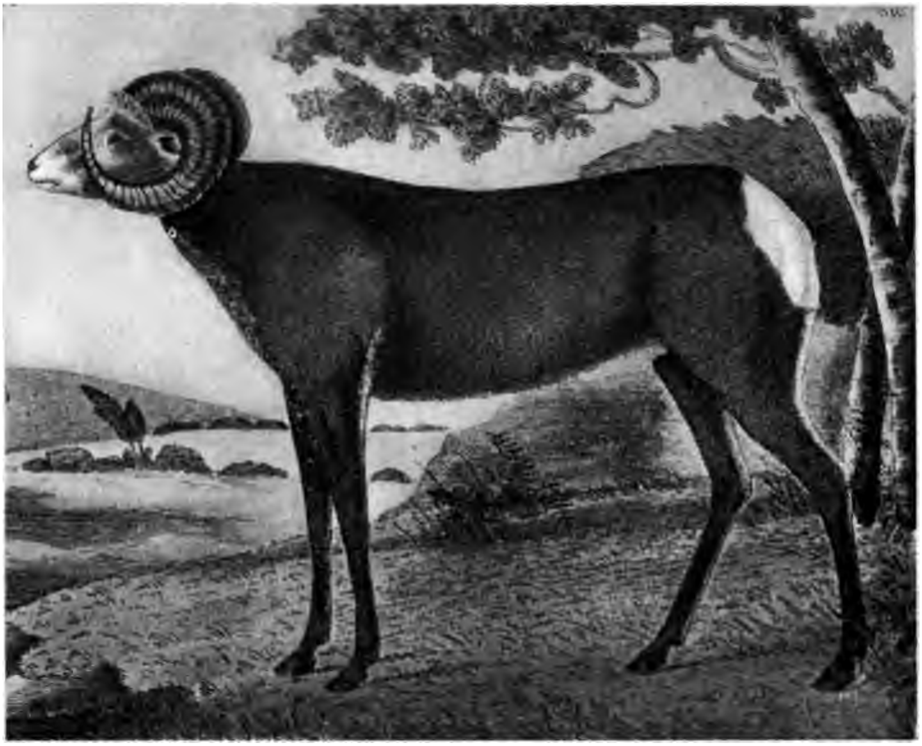

Fig. 3. Reversed and modified copy of plate in Ann. du Mus. Nat. Hist., Vol. II, plate lx. See Fig. 2. Based originally on same drawing as Fig. 1.

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[1] The First Story of a Sheep Hunt. Forest and Stream, Vol. LXXV, No. 18, pp. 692, 693. See also a further account, with references to Geoffroy, Shaw, and Desmarest, in the number of this journal for Nov. 19, 1910, pp. 811, 812.

As republished in the 'European Magazine and London Review' (judging by the literal reprint of it in 'Forest and Stream' in 1910), the article is divided into seven paragraphs, the sentences begin uniformly with a capital letter, and many superfluous commas are omitted. In other respects it is almost an exact reproduction of the original 'Advertiser' text.

Through the courtesy of Dr. George Bird Grinnell, editor of 'Forest and Stream,' I have been able to examine the original article in a file of the 'Advertiser' discovered by him in the New York Society Library.

GEOFFROY'S BELIER DE MONTAGNE.

The first French account of the Rocky Mountain Sheep, by the eminent naturalist Etienne Geoffroy St. Hilaire, appeared in the 'Annals' of the Paris Museum of Natural History for 1803, under the title 'Description d'une nouvelle espèce de belier sauvage de l'Amérique septentrionale.[1] Geoffroy says:

> "Le directeur du Muséum de New-Yorck, M. Savage, a bien voulu, à la sollicitation de M. Lormerie, agriculteur français, nous envoyer la figure d'un belier de l'intérieur des terres, qui est à peine connu des Anglo-Américains euxmêmes. Il nous prévient qu'il n'a pu faire cette figure que sur la peau bourrée qui est dans son Muséum, mais qu'au surplus il s'est attaché à copier avec la plus grande exactitude les couleurs et les traits qui peuvent le mieux servir à caractériser cette nouvelle espèce.[2] Dans l'intention de suppléer à ce que son dessin ne pouvoit exprimer, il a eu la complaisance de nous adresser une notice qu'on a imprimée dans le journal américain l'*Avertisseur*, et qui a été rédigée sur les lieux même où l'animal a été découvert. Cette notice nous apprend qu'on doit la découverte de cet animal à un Anglais nommé M. Gillevray. . . . "[3]

From these sources of information Geoffroy characterized the species as "un animal à corps de cerf et à tête de belier," and further observes: "Il est assez singulier qu'un animal que la forme de sa tête et de ses cornes place dans le genre des beliers ait la taille svelte et élégante de nos cerfs;. . . . En effet, le *belier de montagne*. . . . a le poil court, roide, grossier et comme desséche. Ses couleurs rentrent dans celles des cerfs, des chevreuils, et son pélage est brun-marron;. . . . " He quotes McGillivray's measurements, and summarizes his account of its habits and haunts. He was evidently strongly impressed with its cervine features of form and pelage, and derived from the drawing an erroneous conception of its coloration.[4] His artist, in reproducing Savage's drawing, idealized it on these lines. Savage's drawing, as published in the 'Medical Repository' (here reproduced in Fig. 1), is of normal proportions for an old ram of this species as to both the body and the limbs, and the horn is truncated at the tip, through the natural abrasion usually seen in very old rams, and the tip rises only to the level of the eye. The depth of the body behind the shoulders is only about one-third the total length, and just equals the length of the fore limb.[1] In Geoffroy's plate the body is much slenderer and the legs much longer, the fore limbs being considerably longer than the depth of the body at the shoulders. The horn (only one can be seen) terminates in a point, which is not on a level with the eye but considerably above the dorsal outline of the forehead. (See Fig. 2.) These facts are noted in detail on account of their bearing on the source of the plate accompanying Shaw's description, soon to be considered. (See Fig. 3.) Geoffroy's plate was uncolored; Shaw's was colored to agree with Geoffroy's description.

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[1] Ann. du Mus. d'Hist. nat., Tome II, An. XI (1803), pp. 360–363, pl. lx.

[2] In this connection attention may be called to the accompanying Figures 1 and 2, showing Savage's drawing as reproduced in the 'Medical Repository' and Geoffroy's modified reproduction of the same drawing.

[3] Notwithstanding Geoffroy's explicit statement as to the basis of his information, Richardson says (Faun. Bor.-Amer., I, 1829, p. 272): "This specimen [McGillivray's] being afterwards sent to M. Geoffroy, he published a description of it with a figure in the *Annales du Museum*"! This error was repeated by Audubon and Bachman, and by other later authors.

[4] Possibly during the two years of exposure in camp life and travel the original color may have become changed by staining to such a degree as to mislead the artist as to its proper color. It is otherwise difficult to explain the erroneous coloring of Mr. Savage's drawing.

OVIS CERVINA DESMAREST.

Geoffroy while giving all the information at his command, and idealizing in the plate his impressions of how the species should look, failed to give it a technical name, merely designating it, in his text and on the plate, as the Belier de Montagne. One year later, however, in 1804, this was supplied by another French naturalist, A. G. Desmarest, who formally introduced the species into technical nomenclature as *Ovis cervina.*[2] Desmarest's description is avowedly based on Geoffroy's, all but eight lines of which are given in quotation marks from Geoffroy.

OVIS CANADENSIS SHAW.

Almost simultaneously with the publication of Desmarest's account, as far as it is possible to determine, the Rocky Mountain Sheep was briefly described and figured in Shaw and Nodder's 'Naturalist's Miscellany,'[3] under the name *Ovis canadensis*, the text being in Latin and English, and the plate colored. Shaw cites Geoffroy only, on whose account both the description and plate are obviously based, although he adds at the end of his description: "A very fine specimen of this rare quadruped may be seen in the British Museum." This can have been no other than the specimen sent by McGillivray to London in 1803, as already detailed. Shaw's plate

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[1] Savage's figure in the 'Medical Repository' is noteworthy for its accuracy, though less artistic than that of Geoffroy's artist and Nodder's plate; yet we find it thus criticised by an American author in 1825: "In the New York Medical Repository, (vol. vi., p. 238, 1803), is a description, accompanied with an indifferent figure, of the *Argali* of North America, under the name of Mountain Ram."— HARLAN, Fauna Americana, 1825, p. 262.

[2] Nouv. Dict. d'Hist. nat., Tome XXIV, An. XII (1804) pp. 5, 6.

[3] Nat. Miscel., Vol. XV, pl. 610, and accompanying text (4 pp.), unpaged and without date.

(drawn by Nodder) is evidently a reversed copy of Geoffroy's, with the cervine form of body and limbs still further emphasized, the horn-tip just as perfectly restored, and a background added (Fig. 3). It is not likely that this close agreement would have happened had Nodder made his drawing from an actual specimen, say the original McGillivray specimen then in London. The coloring, ferruginous brown, of both Shaw's diagnosis and the plate, is evidently the "brun-marron" of Geoffroy.

It is hence perfectly evident that McGillivray's description of his Mountain Ram and Savage's drawing of the same specimen served jointly as not only the basis of Geoffroy's description and figure, and hence of Desmarest's name *Ovis cervina*, but also of Shaw's *Ovis canadensis*, while Geoffroy's account gave rise, much later, to Cuvier's name *Ovis montana.*

OVIS MONTANA CUVIER, AND REVIVAL OF THE NAMES OVIS CERVINA AND OVIS CANADENSIS.

Cuvier's name *Ovis montana* is merely a Latin translation of Geoffroy's French vernacular name, "belier de montagne.[1] Blainville in 1818, and most later authors for the next fifty years, erred in ascribing the name *Ovis montana* to Geoffroy.[2]

If Geoffroy had really used this name instead of the French equivalent it would have saved disagreement among modern nomenclators over the question of priority between *O. cervina* and *O. canadensis,* as when *O. montana* was used by Cuvier it was preoccupied by an *Ovis montana* given by Ord in 1815 to the Rocky Mountain Goat. Yet this name was used almost exclusively for the sheep until 1880, when Alston[3] adopted *Ovis cervina* Desmarest, on the ground that *Ovis montana* was preoccupied; but he wrongly took Desmarest's name from 1818 instead of from the original date, 1804.

Merriam, in 1890 and 1891,[4] employed *Ovis canadensis* Shaw as the earliest available name, and later[5] gave his reason for this selection, claiming 1803 as the date of publication of this name.

Rhoads, in 1894,[6] rejected *Ovis canadensis* Shaw as "unavailable," for the reason that Shaw's work is "without any date whatever,.... though it [the name *Ovis canadensis*] has priority over any other." (*Ovis cervina* is here wrongly cited as dating from 1818.)

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[1] "Le Moufflon d'Amérique. (*Ov. montana.*) Geoff. Ann. du Mus. II, pl. lx."—CUVIER, Règne Anim., I, Dec. 7, 1816, p. 267.

[2] Desmarest used *Ovis cervina* for the species as late as 1818, but abandoned it in 1822 for *Ovis montana*, without giving any reason for making the change. Later *Ovis montana* was wrongly credited by many authors to Desmarest.

[3] Biologia Centrali-Americana, Mamm., p. 111, June, 1880.

[4] North Amer. Fauna, No. 3, p. 78, Sept. 11, 1890; *ibid.*, No. 5, p. 81, July, 1891.

[5] Proc. Biol. Soc. Washington, XIV, p. 29 (footnote), April 5, 1901. He here says that he "adopted the name *canadensis* as of unquestionable priority."

[6] Reprint of Ord's North American Zoology, 1894, Appendix, p. 25; Amer. Nat., XXVIII, June, 1894, p. 526.

In the following year the present writer[1] also employed the name *Ovis cervina* Desmarest (here cited correctly, almost for the first time, as dating from 1804) as preferable, on the ground that "there can be a difference at most of but a few months in the publication of the two names. Obviously the name having a positive date should have preference." Elliot, in 1901,[2] adopted *Ovis cervina*, and this name and *O. canadensis* both have at present about equal currency.

While the name *Ovis cervina* Desmarest is known to have been published early in 1804, the date of *Ovis canadensis* Shaw has been assumed, on hypothetical grounds, as December, 1803.[3] The careful collation of Shaw and Nodder's work given below shows that the actual date of publication of this name was almost unquestionably February, 1804, and could not have been in 1803.

Collation of Shaw and Nodder's 'Naturalist's Miscellany.'

This work, of twenty-four volumes, was published in monthly parts, beginning August 1, 1789. The first volume has an engraved title-page[4] bearing date 1790, and also two dedicatory title-pages, facing each other, one in Latin, the other in English, but carrying no date. Each following volume has also two similar printed dedicatory undated title-pages, each volume being inscribed to a different person or to some learned Society.[5] The only dates of publication for any part of the work (in the copy examined), except the first volume, are those engraved on the plates. Thus all the plates in Volume I are dated.[6] The plates are all, with rare exceptions (in which the plates are not even numbered), dated in a similar manner to the end of Volume V; in Volume VI only one plate is dated in each of six parts, two are dated in five parts, and three in the last or August part. In Volume VII usually only one plate is dated in each part, and the same is true of Volume VIII as far as plate 265, the first plate in the December part; the plates in the rest of the volume are all without dates. The first plate of Volume IX is dated (Sept. 1, 1797), and the next 29 plates have no date; for the rest of the volume one or more plates are dated in each part, and all are dated in the final part (August, 1798). In Volumes X, XI, XII, and the first three parts of Volume XIII, nearly all the plates are dated. From this point on to the end of the work very few plates are dated, in most of the volumes none, and when dated only the year is given.

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[1] Bull. Amer. Mus. Nat. Hist., VII, p. 258, June 29, 1895.

[2] Synopsis of the Mammals of North America, 1901, p. 46.

[3] Cf. Sherborne, Ann. and Mag. Nat. Hist. (6), April, 1895, pp. 376.

[4] Vivarium Naturæ or the Naturalist's Miscellany. Vol. I. Dedicated by permission to Her Majesty. By G. Shaw M. D., F. R. S. the Figures by E. P. Nodder, Botanic Painter to Her Majesty. London. Printed for Nodder & Co., 15 Brewer Str. Golden Sq. 1790. [24 vols., Royal 8vo, 1790–1813.]

[5] The English version of the dedication in volume I is as follows: To the | Most Illustrious Princess, | Charlotte, | Queen of Great Britain, | not less distinguished by | Her Virtues | than Her Station, | this First Volume | of the | Naturalist's Miscellany | is | with profound humility inscribed | by | Her Majesty's most devoted | and | most obedient subjects and servants, | George Shaw, | Frederick P. Nodder.

[6] Plate 1 is inscribed across the bottom: "Published Aug^{t}. 1, 1789, by F. P. Nodder and C^{o}., N^{o}. 13 Panton Street." The inscription at the bottom of Plate 16 is: "Published Jan^{ry}. 1st 1790, by F. P. Nodder & C^{o}. N^{o}. 13 Panton Street." The plate inscriptions are similar throughout the next five or six volumes.

Each volume is furnished with an index consisting of a single leaf. In 1813, a general index was issued, probably with the concluding part, with references for both the Latin and English names, to both the volumes and the plates.

In the course of the work seven plates have no numbers, and ten are wrongly numbered, through errors in engraving; but their serial relation is evident from their position in the volumes and by the subject references in the indexes. In the October part of Volume XIII the dates and numbers are not serially conformable, plates 497 and 498 being dated October 1, 1801, while plates 499 and 500 are dated Sept. 1, 1801. In Volumes IX and X plates 339 and 349 are dated 1789 instead of 1798, and plate 360 is dated 1770 instead of 1789.

The copy of the work examined has been collated with the volume indexes in order to determine whether the plates included together as volumes have been properly made up for binding, and no error in this respect has been found. The plates themselves have been listed serially, by volumes, throughout the work and the date, or the absence of a date, noted for each plate. The results of the collation, as given below, are thus based on thorough study, with a view to their possible usefulness to others.

Mr. Sherborne[1] refers to the prospectus of this work as announcing its publication to be in monthly parts, beginning August 1, 1789, each part to consist of "three, and sometime more" plates. My collation shows that the first two volumes contained 37 plates each, an extra plate having been issued with the part for April, 1790, and with the part for February, 1791. The next succeeding five volumes (III-VII) contain only 36 plates each, issued regularly at the rate of three plates per month. Volume VIII contains 46 plates, the first two parts consisting each of three plates, and the remaining ten parts having four plates each. This number was maintained for each subsequent part, and the following volumes contain 48 plates each except the last which has only 44,[1] lacking the August issue, owing to the illness and death of Dr. Shaw, who died July 22, 1813.[2]

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[1] Ann. and Mag. Nat. Hist. (6), XV, 1895, p. 376.

Volumes I–V began with August and ended with the part for the following July. No part was issued in March, 1795, and the volume (Volume VI) ended with August instead of July, as previously. So far as the dates on the plates and the number of plates in each volume give evidence, all the remaining volumes, beginning with Volume VII, began with August and ended uniformly with the July part.

The above data may be presented in tabular form, as follows:

Tabular Statement.

N. B.— Hypothetical dates are enclosed in brackets [–].

Volumes.	Number of Plates per Volume.	Plates and Dates.					Plates and Dates.			
I.	37	1– 15,	Aug. 1,	1789–	Dec. 1,	1789	16– 37,	Jan. 1–	July 1,	1790
II.	37	38– 52,	“	1790–	“	1790	53– 74,	“	“	1791
III.	36	75– 87,	“	1791–	“	1791	88–110,	“	“	1792
IV.	36	111–125,	“	1792–	“	1792	126–146,	“	“	1793
V.	36	147–161,	“	1793–	“	1793	162–182,	“	“	1794
VI.[3]	36	183–197,	“	1794–	“	1794	198–218,	“	Aug. 1,	1795
VII.	36	219–230,	Sept. 1,	1795–	“	1795	231–254,	“	“	1796
VIII.	46	255–268,	“	1796–	“	1796	269–300,	[“	“	1797]
IX.	48	301–316,	“	1797–[	“	1797]	317–348,	[Jan. 1–]	Aug. 1,	1798
X.	48	349–365,	“	1798–	“	1798	366–396,	Jan. 1–	“	1799
XI.	48	397–412,	“	1799–	“	1799	413–444,	“	“	1800
XII.	48	445–460,	“	1800–	“	1800	461–492,	“	“	1801
XIII.	48	493–508,	“	1801–	[Dec.	1801]	509–540,	[Jan. 1–	Aug. 1,	1802]
XIV.	48	541–556,	[Sept.	1802–	Dec.	1802]	557–588,	[“	“	1803]
XV.	48	589–604,	[Sept.]	1803–	[Dec.	1803]	605–636,	[“	“	1804]
XVI.	48	637–652,	[Sept.	1804–	Dec.	1804]	653–684,	[“	“	1805]
XVII.	48	685–700,	[Sept.	1805–	“]	1805	701–732,	[“	“	1806]
XVIII.[4]	49	733–748,	[“	1806	“	1806]	749–780,	[“	“	1807]
XIX.	48	781–790,	[“	1807–	“	1807]	797–728,	[“	“	1808]
XX.	48	729–844,	[“	1808–	“	1808]	845–876,	[“	“	1809]
XXI.	48	877–892,	[“	1809	“	1809]	893–924,	[“	“	1810]
XXII.	48	925–940,	[“	1810–	“	1810]	941–972,	[“	“	1811]
XXIII.	48	973–988,	[“	1811–	“	1811]	989–1020	[“	“	1812]
XXIV.	44	1021–1036	[“	1812–	“	1812]	1037–1064	[“]–Aug.		1813

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[1] There is, however, one other exception: In volume XVIII, the part for July (1806), had apparently five plates, and the volume 49 plates, there being two, with different subjects numbered 774.

[2] Volume XXIV contains an engraved memorial (bound at the end of the last volume in the present copy) to Dr. Shaw, on which is inscribed the date of his death, at the age of 60 years.

[3] No part was issued in March, 1795, and the volume ended in August instead of July.

[4] The July part contained 5 plates, No. 774 having been given to two different plates, making 49 plates for the volume.

Explanatory Notes.

The following data are supplementary to the above Table. Many of them have been given in the text preceding the Table, but are here presented with many others in more convenient form for reference, in the order of the volumes.

Vol. I. All the plates are dated. This is the only volume in which all the plates have dates.

Vol. II. All but 4 of the plates are dated; these, with the obvious date of issue, are: no. 44, Oct. 1, 1790; no. 62, March 1, 1791; no. 69, June 1, 1791; no. 72, July 1, 1791.

Vol. III. All but two of the plates are dated: these are no. 78, Aug. 1, 1791; no. 103, May 1, 1792.

Vol. IV. All plates are dated except no. 112, Aug. 1, 1792; no. 124, Dec. 1, 1792; no. 146, July 1, 1793.

Vol. V. Four plates are without dates: no. 151, Sept. 1, 1793; no. 169, March 1, 1794; no. 172, April 1, 1794; no. 182, July 1, 1794.

Vols. VI and VII. One or more plates are dated in each monthly part, except in the issue for March, 1795; the dated plates render practically certain, as in the previous volumes, the month of issue of the undated plates.

Vol. VIII. The first two monthly parts contained each 3 plates, and the remaining ten parts each 4 plates. Only the first plate in each of the first four parts is dated, the last dated plate being no. 265, dated Dec. 1, 1796.

Vol. IX. The first plate of the volume (no. 301) is dated Sept. 1, 1797; the next plate bearing a date is no. 331, dated April, 1798; 1 plate of the May, 3 plates of the June, 3 of the July, and all of the plates of the August issue are dated.

Vol. X. Most of the plates in each monthly part are dated.

Vol. XI. In this volume all the plates are dated except one in the September issue, which has neither date nor number.

Vol. XII. Each monthly part has two, three, or all four of the plates dated.

Vol. XIII. All the plates in the September, October, and November parts are dated, except two in the September issue. No plates in this volume after the November issue (pll. 505–540) are dated.

Vol. XIV. Only one plate is dated; this is plate 553 of the December issue, which bears simply the date of the year (1802).

Vol. XV. Only 7 plates are dated, and these bear only the year, namely, no. 589, the first plate in the volume, which is dated 1803. All the four plates of the April issue are dated 1904, and there is one plate thus dated in the May issue. The *Ovis canadensis* plate, no. 610, belongs to the February part, on the basis of four plates in each monthly issue, there being 48 plates in the volume. This plate has previously been assigned to December, 1903.[1]

Vol. XVI. No plates are dated.

Vol. XVII. Only one plate is dated, no. 699, in the issue for December, which is dated 1805.

Vol. XVIII. No plates are dated.

Vol. XIX. The single dated plate is no. 804, dated 1807.

Vol. XX. No plates are dated.

Vol. XXI. Only five of the 48 plates are dated; three of them are dated 1809, and two, 1910.

Vol. XXII, XXIII, XXIV. In these volumes no plates are dated.

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[1] *Cf.* Sherborne, *l. c.*, p. 376.

DATE OF OVIS CANADENSIS SHAW.

From the foregoing it is evident that the date of publication of the name *Ovis canadensis* Shaw cannot be positively determined, but in all probability was early in February, 1804. There is little room for doubt that *Ovis cervina* Desmarest was published also early in 1804. The 'Nouveau Dictionnaire d'Histoire Naturelle' appeared in 1803 and 1804, in twenty-four volumes, the first twenty-one of which, according to the title-page dates, were published in 1803, and the last three in 1804. The volumes were thus published at the rate of about two a month, and doubtless Volumes XXII and XXIII, and possibly also Volume XXIV, appeared in January, 1804. On the other hand, it must be assumed that from November, 1801, on to the end of Shaw and Nodder's work in 1813, the plates were issued regularly, four in a part for each month, in order to fix even a hypothetical date for any of them. There is, however, evidence that this regularity of issue was not always maintained. The last 560 plates, comprising all the plates in the last 12 volumes except the first 12 of Volume XIII, are wholly without dates except for 15, scattered at wide intervals, which give the year. No plates are definitely dated after November 1, 1801. It seems therefore that where a question of priority between two names is at stake, the only proper course is to accept the name which was published in a work of known date rather than the alternative undated name, the probable or approximate date of which depends upon an assumption and mathematical computation.

OTHER EARLY REFERENCES TO THE MOUNTAIN SHEEP OF NORTH AMERICA.

It is of interest to note in this connection that the next references to the Rocky Mountain Sheep, following McGillivray's discovery of the species, based on personal observation of the animal in life, occur in Paul Allen's narrative of the Lewis and Clark Expedition.[1] These explorers first became acquainted with the species in 1805, in the badlands of the Upper Missouri (first met with a little below the mouth of the Yellowstone), and the next specimens after McGillivray's to reach civilization were the pair (male and female) brought by them to Philadelphia on their return in 1806. Very good figures of them were published by Godman in 1826 in his 'American Natural History.'[2] He identified them with the Argali of Siberia, and says of them: "Two specimens of the Argali, a male and female, were brought in by Lewis and Clarke, and may be seen in the Philadelphia Museum, where they are preserved." The plate of an old ram in Griffith's 'Animal Kingdom' (Vol. IV, 1827, facing p. 318) was also drawn from the Lewis and Clark specimens.[1]

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[1] History of the Expedition under the command of Lewis and Clark to the Sources of the Missouri, thence across the Rocky Mountains and down the River Columbia to the Pacific Ocean. Performed during the Years 1804–5–6, etc. 2 Vols., 8vo, 1814.

[2] Vol. II, 1826, p. 329, with an original plate.

Barton had, however, in 1804,[2] published the story of a Mohawk Indian who had apparently reached the sheep country of the Upper Missouri on a journey northwest from Detroit, to the effect that he had met with "a kind of Sheep with a hairy back, much like a deer, but having long wool over its belly, and large horns (one of which he saw weighed seven pounds)." Barton further says, in the same article: "The existence of a large species of sheep, in the same tract of country ["adjacent to the sources of the Missouri"] is no longer doubtful. This is probably the Argali of Asia. It is unquestionably the *Taye*[3] of the Monqui-Indians, who reside in California. A figure of this animal was published by Venegas as early as the year 1757, in the first volume of the *Noticias de la California*, printed at Madrid."

In the following year Barton again referred to the sheep of the Missouri badlands in a further account of the Taye,[4] stating: "I have myself received some additional information concerning the existence of a large horned animal, in all probability the Taye, in the country adjacent to the river Missouri. . . . This animal is a native of the Stony-mountains [Rocky Mountains of to-day] about the headwaters of the Missouri." He refers to the use of its horns by the Indians, etc., and considers "the existence of a native sheep in North-America, is thus sufficiently established," but that it "remains to be ascertained whether it is a species *peculiar* to this continent or one *common* to it and the old world." Barton was obviously ignorant, of McGillivray's account, published in 1803, and his comment on the subject of sheep in North America is mainly of interest as being apparently the first reference in any scientific journal to the wild sheep of the Missouri River country, the existence of which there was soon after established by Lewis and Clark's specimens and the narrative of their explorations.

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[1] In an effort to trace the history of these specimens further, I wrote to Mr. Witmer Stone, Curator of Mammalogy and Ornithology, Academy of Natural Sciences of Philadelphia, in the hope of obtaining further information. His reply (*in litt.*, Jan. 6, 1912), though negative in character, is of interest, as follows: "The Lewis and Clarke material all went to Peale's Museum so far as I know. Lewis's Woodpecker and Clarke's Crow are explicitly based upon Peale's Museum specimens by Alexander Wilson. Furthermore I do not think the Academy was ever referred to as the 'Philadelphia Museum.' That term was the regular title of Peale's Museum in 1826 and later. It is hard to say where the specimens may be by this time. The birds that turned up in the Boston Society some years ago and three birds purchased by our Academy are the only Peale's Museum specimens that I know of."

[2] Medical and Physical Journal, I, 1804, pp. 75, 77, in an article entitled 'Notice of the Travels of a Mohawk-Indian.'

[3] The "Taye" and its interesting history will be considered later.

[4] Med. and Phys. Journ., II, 1805, pp. 106–113, in an article entitled: "Some Account of the Tayè, a species of Sheep.'

It is rather surprising that Sir Alexander Mackenzie did not acquire some definite information of wild sheep in 1793, on his wonderful voyage from Fort Chepewyan over the Rocky Mountains to the mouth of the Frazer River, but he evidently did not meet with them, although the mountains flanking the Peace River–Frazer River divide, in about latitude 55° north, is 'sheep country.' While in camp at the head of Peace River, on June 10, the natives, he says, gave him among other things, "the skin of a moose-deer, dressed, and a white horn, in the shape of a spoon, which resembles the horn of the buffaloe of the Copper-Mine River; but their description of the animal to which it belongs does not answer to that."[1] Yet Richardson surmised, and no doubt, correctly, that this spoon was made from the horn of a mountain sheep.[2]

Mackenzie also learned from the natives of the occurrence of "small white buffaloes" in the mountains west of the lower Mackenzie River,[3] which have been identified by various later writers with the White Sheep (*Ovis dalli dalli*) described by Nelson in 1884.

THE TAYE OF "CALIFORNIA."

As is well known, the sheep discovered by McGillivray in the year 1800 in southern Alberta, was not the first form of American sheep known to explorers and historians. Pennant in his 'Arctic Zoology,' published in 1784 (Vol. I, p. 12), refers to "certain quadrupeds of this genus [sheep]" as having been observed by missionaries in California in 1697, and quotes their account as found in Jones's 'Abridged Philosophical Transactions' (Vol. V, part 2, p. 195). Richardson quotes from the same account as originally published in the unabridged 'Philosophical Transactions' of much earlier date.

A similar account of the sheep is given by Venegas in his 'History of California,' published in Madrid in 1758, and republished in English in two volumes in 1759.[1] The most interesting feature of Venega's account is the figure of the "Taye or Californian Deer," here reproduced in Fig. 4.

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[1] Voyages from Montreal through the Continent of North America, English ed., 1802, Vol. II, p. 95; Amer. ed., 1802, p. 150.

[2] Faun. Bor.-Amer., I, 1829, p. 272.

[3] Voyages from Montreal, etc., English ed., Vol. I, 1802, pp. 202, 239; Amer. ed., pp. 29, 56.

The Venegas account has been referred to or more or less fully quoted by many subsequent authors, but his description of the Taye is merely a paraphrase of Father Piccolo's statement, published originally in Paris some fifty years earlier, and republished in English in the 'Philosophical Transactions' for 1708.[2] The explanatory title of Piccolo's article is:

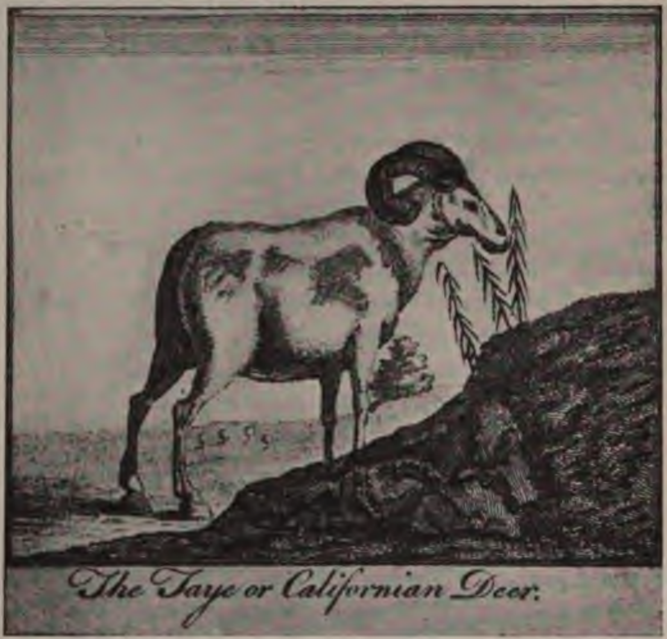
The Taye or Californian Deer.

Fig. 4. From Venegas's Nat. and Civ. Hist. of California, Vol. I, 1759, lower figure of plate facing p. 36.

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[1] A Natural and Civil | History | of | California: | containing | an accurate Description of that Country, | Its Soil, Mountains, Harbours, Lakes, Rivers, | and Seas; its Animals, Vegetables, Minerals, | and famous Fishery for Pearls. | The | Customs of the Inhabitants,| Their Religion, Government, and Manner of Living, | before their Conversion to the Christian Religion by | the missionary Jesuits. | Together with | Accounts of the several Voyages and Attempts made for | settling California, and taking actual Surveys of that | Country, its Gulf, and Coast of the South-Sea. | Illustrated with | Copper Plates, and an accurate map of the Country and | the adjacent Seas. | Translated from the original Spanish of Miguel Vene-| gas, a Mexican Jesuit, published at Madrid 1758. In two Volumes. | — | Vol. I. | London: | Printed for James Rivington and James Fletcher, | at the Oxford Theatre, in Pater Noster-Row. 1759. |

The original Spanish edition is said to be titled 'Noticias de la California'.

The sheep matter in Venegas occurs in Vol. I, pp. 36, 37, with a figure of the Taye on the plate facing p. 36.

[2] Phil. Trans., Vol. XXVI, No. 318, for the months of November and December, 1708, pp. 232–240, with Kino's map. The Taye matter is at p. 336.

"An Extract of a Memoir, concerning the Discovery of a passage by Land to California; with a Map and Description of that Country. Presented to the Royal Council of Guadalaxara in Mexico, by Francis Maria Picolo.[1] Taken from the Letters of the Missionary Jesuits, printed at Paris." The memoir is dated "Guadalaxara, Mexico, February, 10, 1702." The accompanying map is entitled 'A Passage by Land to California Discovered by the Rev. Father Eusebius Francis Kino jesuite beyween y^{e} years 1698 and 1701." Piccolo's reference to the Taye is here quoted in full, it being the source of all subsequent accounts of sheep in California based on the records of the early Jesuit missionaries.[2]

> "Besides several sorts of Animals that we knew, which are here in plenty, and are good to eat, as Stags, Hares, Coneys, and the like; we found two sorts of Deer, that we knew nothing of: We call them Sheep, because they somewhat resemble ours in make. The first sort is as large as a Calf of one or two Years old: Its Head is much like that of a Stag; and its Horns, which are very large, like those of a Ram: Its Tail and Hair are speckled, and shorter than a Stags: But its Hoof is large, round, and cleft as an Oxes. I have eaten of these Beasts; their Flesh is very tender and delicious. The other sort of Sheep, some of which are White, and others Black, differ less from ours; They are larger, and have a great deal more Wool, which is very good, and easy to be Spun and Wrought."

Father Juan Maria de Salvatierra crossed the Gulf of California from the mouth of the Yaqui River, Sonora, to California and took formal possession of the country in the name of the King of Spain October 25, 1697, and was soon joined by Father Francis Maria Piccolo. They established missions during the following five years of their sojourn here, at various points from about latitude 26° southward to La Paz. It was in this region that they became acquainted with the Taye, as recorded by Piccolo, the historian of these first attempts to establish missions in what is now Lower California. Hence the 'California' where the Taye was found in 1697 was the peninsula of Lower California south of north latitude 26°, and not the present State of California, which at that time had not become a field of missionary enterprise, nor had the country then received a distinctive name.

It is of interest to note that sheep still exist where the first Spanish missionaries found them in 1697. Dr. Charles H. Townsend on his recent 'Albatross' expedition to Lower California in the interest of this Museum, obtained some imperfect skulls of mountain sheep from the natives at Conception Bay, and saw a living specimen in the low mountains at the head of the bay. He also informs me that mountain sheep are said still to inhabit the low mountains near the Gulf coast as far south as Saltillo del Rey, or to within about one hundred miles of La Paz, and that they range thence northward in all the high hills and mountains, especially on the Gulf side, nearly to the United States boundary.

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[1] The correct spelling of the name is Piccolo.

[2] Clavigero (Stor. ant. del Messico, IV, 1781, p. 158), often cited in this connection, gives four lines to the Tajé, identifying it with the ibex of Pliny and the quentin of Buffon.

The Lower California mountain sheep received its first technical name in 1903, when it was described by Dr. D. G. Elliot as *Ovis cervina cremnobates*,[1] the description being based on specimens from the San Pedro Martir Mountains, in the northern part of the Peninsula. It is closely related to the previously described *Ovis nelsoni* Merriam, from the Grapevine Mountains, on the boundary between California and Nevada, and also to *Ovis canadensis gaillardi* Mearns (1907), from the Gila Mountains, near the boundary of southwestern Arizona and Sonora.

Many authors have made the mistake of supposing that the "California" mountain sheep of the seventeenth century Spanish missionaries was the sheep of the modern State of California. Sir John Richardson, in 1829, stated that "Mr. David Douglas described Piccolo's sheep under the name *Ovis californica*."[2]

OVIS CALIFORNIANUS DOUGLAS.

In 1829, David Douglas described a North American sheep under the name *Ovis californianus*.[3] No type locality is stated, but he says that the only specimen he had been able to examine was taken near Mount Adams ("Lat. 46. 14. 55., Long. 121. 17. 0"), in what is now Yakima County, Washington. This should evidently be taken as the type locality, notwithstanding the name *californianus* is applied to the species, and his statement that it "is more numerous in the mountainous districts of California," than in "the subalpine regions of *Mounts Wood* [Hood], *St. Helens*, and *Vancouver*." In this account of *Ovis californianus* he makes no reference to the Taye of Lower California.

NORTHERN MOUNTAIN SHEEP.

The sheep of the far north are, so far as known at present, specifically distinct from the sheep of the Rocky Mountains of southern Canada and the United States, the mountainous districts of northern Mexico and Lower

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[1] Field Columbian Museum, Zoöl. Ser., III, No. 14, p. 239, Dec., 1903.

[2] Fauna. Bor.-Amer., I., p. 272. As no page is cited in the reference he gives to the 'Zoological Journal,' where the species was described, it is probable the description had not been published at the time he wrote this statement, and hence the error in the specific name, given as *californica* instead of *californianus*.

[3] Zoological Journal, IV, p. 332, Jan., 1829.

California, and (formerly) the Cascade Mountains and the Sierra Nevada of California. The numerous 'subspecies' of this group are all closely related to the sheep of the central Rocky Mountains, they differing only slightly in coloration, in size, or in any other characters, although the southern forms have long been restricted to isolated areas. It is to this fact as much as to any marked evidences of differentiation that appears to have led to their recent recognition as nameable forms.

The sheep of northern Canada and Alaska differ strongly from the southern group in coloration, in size, and in the conformation of the horns. The three or four forms of the northern group commonly recognized present a wide range of color variation, the most northern phase being practically pure white, while the most southern form is so dark as to be commonly known as the *black* sheep. Notwithstanding this striking difference in color, they are otherwise but slightly and rather inconstantly differentiated, while, as recently shown by Sheldon,[1] they completely intergrade over a large intermediate district. The southern form of this group does not, so far as known, intergrade with the adjoining form of the southern group, nor is it known whether their respective ranges actually meet.

The white sheep of Alaska [2] was described and named in 1884, from specimens taken near Fort Reliance on the Upper Yukon, Alaska.

The black sheep of northern British Columbia was described and named in 1897,[3] from specimens taken in the Cheonnee Mountains in northwestern British Columbia, and an intermediate type in 1901,[4] from specimens taken near Dawson City, Yukon Territory.

Richardson's "*Ovis montana* Desmarest," as shown by both the description and plate,[5] is doubtless a composite of *O. dalli* and *O. stonei*, the white male being apparently referable to *dalli* and the dark female to *stonei*. The locality, "the mountains which skirt the south branch of the Mackenzie [Liard River]," whence these specimens are said to have come is vague, and evidently Richardson's first-hand knowledge of the sheep of the Northern Rockies was extremely limited. His description of the coloration of the two specimens figured indicates that he believed the difference in color to be seasonal.

"The head, buttocks, and posterior part of the belly, are white; the rest of the body and the neck are of a pale umber or dusky wood-brown colour. A deeper and more shining brown prevails on the anterior aspect of the legs. The tail is dark brown, and a narrow brown line, extending from its base, runs up betwixt the white buttocks, to unite with the brown colour of the back. The colours reside in the ends of the hair, and as these are rubbed off during the progress of the winter, the tints become paler. The old rams are almost totally white in the spring. This is the case with the male specimen of our plate. The female in the back ground, presents the colours mentioned above."

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[1] The Wilderness of the Upper Yukon: A Hunter's Exploration for Wild Sheep in Sub-Arctic Mountains. By Charles Sheldon. New York, 1911.

[2] *Ovis montana dalli* Nelson, Proc. U. S. Nat. Mus., VII, 1884, p. 12.

[3] *Ovis stonei* Allen, Bull. Amer. Mus. Nat. Hist., IX, 1897, pp. 111–114, pl. ii, iii. Redescribed by Lydekker in 1898 (Wild Oxen, Sheep, and Goats, 1898, p. 215) as *Ovis canadensis liardensis*.

[4] *Ovis fannini* Hornaday, Fifth Ann. Rep. New York Zool. Soc., 1901, App. I

[5] Fauna Bor.-Amer., I, 1829, p. 271, pl. xxiii.

According to Biddulph,[1] the male of Richardson's plate was still extant in 1885, as he says: "There is stowed away in one of the basement rooms [of the British Museum] a stuffed specimen in bad preservation, labelled *canadensis*. This is the specimen described and figured by Richardson in the 'Fauna Boreali-Americana.'" He also refers to a specimen from Liard River, "labelled *nivicola* or the Alaskan Wild Sheep," a dark colored specimen which thirteen years later became the type of Lydekker's *Ovis canadensis liardensis*.

According to a letter from Mr. Lydekker to Mr. Sheldon (kindly shown me by Mr. Sheldon), dated November 28, 1905, Richardson's ram was still in the British Museum ("although in very bad condition"), and is regarded by Lydekker as "undoubtedly a *dalli*." Mr. Sheldon (*in litt.*, February 10, 1912) calls my attention to the fact that the "tail of the ram in Richardson's figure is *white*," and it must therefore have been "killed in the Nahanni Mountains (most probably) or farther to the north on the Mackenzie watershed, area 'A'" (on Mr. Sheldon's map of the distribution of sheep in his 'The Wilderness of the Upper Yukon').

SYNONYMIC LIST OF NORTH AMERICAN SHEEP, WITH THEIR TYPE LOCALITIES AND RANGES.

The listing of a form in the following enumeration does not necessarily imply its acceptance by the present writer. The form here entered as *Ovis cervina californiana* has not usually been recognized as tenable; as it is now probably extinct at the type locality and is unrepresented by typical specimens in museums, its real status in relation to other forms can probably never be satisfactorily determined. On geographical grounds it seems as well entitled to enumeration as several of the more southern races now commonly recognized. *Ovis cervina auduboni* is a nearly parallel case with *Ovis californiana* Douglas. Both are admitted as a matter of convenience in compiling the records. This is true also of *Ovis cervina gaillardi*, *O. c. cremnobates*, and *O. dalli fannini*, although the latter seems to be merely an unstable intermediate between *O. d. dalli* and *O. dalli stonei*.

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[1] On the Geographical Races of the Rocky Mountain Bighorn. By Lieut. Col. John Biddulph. Proc. Zool. Society London, 1885; pp. 678–684. See p. 679 for the reference to Richardson's type.

A. The Ovis cervina Group.

1. **Ovis cervina cervina** *Desmarest.*

The My-Attic, or Mountain Ram DUNCAN MCGILLIVRAY, New York Daily Advertiser, Dec. 4, 1802; with letter of introduction by E. Savage. Republished in the 'European Magazine and London Review,' 1803 (not seen), and thence republished in 'Forest and Stream,' New York, for Oct. 29, 1910.

Mountain Ram of North America MCGILLIVRAY, New York Medical Repository, VI, No. III, 1803, pp. 237–240, with pl. (Probably published Jan., 1803.) Same as the above, with slight editorial changes and the addition of a figure of the animal drawn by E. Savage, and an introduction by Dr. Samuel Latham Mitchill. McGillivray is usually cited from this source by subsequent authors.

Belier de Montagne GEOFFROY, Ann. du Mus. d'Hist. Nat., II, 1803, pp. 360–363, pl. lx. Based on McGillivray in the 'New York Daily Advertiser' (as cited above) and on a copy of Savage's drawing. The figure, however, is much modified.

Ovis cervina DESMAREST, Nouv. Dict. d'Hist. Nat., XXIV, 1804, pp. 5, 6; Nouv. Dict. d'Hist. Nat., nouv. éd., XXI, 1818, 553. Both based wholly on Geoffroy, as cited above.— ALSTON, Biol. Cent.-Amer., Mamm., p. 111, June, 1880. From Desmarest at 1818.— RHOADS, Reprint of Ord's N. Amer. Zool., 1894, App. p. 25. From Desmarest at 1818.— ALLEN, Bull. Amer. Mus. Nat. Hist., VII, p. 258 (footnote) June 29, 1895. Desmarest is cited at 1804, with discussion of the availability of the name.— ELLIOT, Synop. Mamm. N. Amer., 1901, p. 46; Check List of Mamm. N. Amer., West Indies, etc., 1905, p. 53.

Ovis canadensis SHAW, Nat. Miscel., XV, pl. 610 and text (unpaged and without date). Based wholly on Geoffroy, as cited above.— BIDDULPH, Proc. Zool. Soc. London, 1885, pp. 681, 683 (claims priority for the name, citing *cervina* Desmarest as from 1818.— MERRIAM, N. Amer. Fauna, No. 3, p. 78, Sept. 11, 1890 (San Francisco Mountain and Grand Cañon, Arizona; name *canadensis* employed without comment); Proc. Biol. Soc. Washington, XIV, p. 29 (footnote), April 5, 1901 (priority claimed for the name *canadensis*).— MEARNS, Mamm. U. S. and Mex. Bound. Surv., I, 1907, pp. 235, 236, footnote (synonymy).— PREBLE, N. Amer. Fauna, No. 27, p. 155, Oct. 26, 1908 (range in Alberta).— WARREN, Mamm. of Colorado, 1910, pp. 9–12 (nearly extinct in Colorado; those still remaining are increasing in numbers).

Ovis canadensis typica LYDEKKER, Wild Oxen, Sheep, and Goats, 1898, pp. 209–215, pl. xvii (general account, part); Great and Small Game of Europe, Asia and America, 1901, p. 10 (part).

Ovis montana CUVIER, Règne Anim., I, 1817 (= "Dec 7, 1816") p. 267. Based on Geoffroy's 'Belier de Montagne,' 1803, as cited above.— BLAINVILLE, Journ. de Physique, LXXXVII, 1818, p. 151 (footnote). Name attributed to Geoffroy.— Desmarest, Mamm., Pt. II, 1822, p. 487. Desmarest here abandons his own [illegible] [illegible] *cervina* for *montana*, without comment.— *Ovis montana* was used by [illegible] authors from this date till 1880, and by some for twenty years later, the authority for the name being usually given as Geoffroy, frequently as Desmarest, rarely correctly as Cuvier. The more important recent references are:

Ovis montana BAIRD, P. R. R. Expl. and Surv., VIII, 1857, pp. 673–679, figs. 24–32, part (systematic and general).— ALLEN, Bull. Essex Inst., VI, 1874, 55 (Mt. Lincoln, Colorado).— COUES, Proc. Acad. Nat. Sci. Philadelphia, 1867, p. 136 (horns "often met with about bases of cliffs and precipices").— COUES and YARROW, Rep. Wheeler Surv., V, Zool., 1875, p. 68 (Santa Fé, N. Mex.)— HORNADAY, Fifth Ann. Rep. N. Y. Zool. Soc. (1900), June 1, 1901, pp. 101–116, 4 half-tone cuts (description and distribution).

Ovis ammon ? MITCHILL, New York Med. Repos., X, p. 35 (footnote), July, 1806. Stony Mountains, on authority of a manuscript journal of James M'Kay. Origin of the myth: "The animal does not live more than ten or twelve years, because the horns make so great a sweep, and grow so far forward as to make it difficult or impossible for the mouth to reach the ground, and graze the herbage for nourishment."

Ovis ammon HARLAN, Faun. Amer., 1825, p. 262. Regarded as merely a variety of the Argali of Asia.— GODMAN, Amer. Nat. Hist., II, 1826, p. 329, with an original plate drawn from the Lewis and Clark specimens.

Ovis pygargus GRIFFITH, Anim. Kingd., IV, 1827, p. 318, V, p. 359, with an original plate by Hamilton Smith drawn from the Lewis and Clark specimens.

Type Locality, near Calgary, Alberta.

Range, Rocky Mountain region, from Alberta and southern British Columbia to New Mexico and central Arizona; in the State of Washington west to the mountains in Ferry, Okanagan and Chelan Counties (W. F. Sheard); also the Blue Mountains of northeastern Oregon (H. E. Anthony).

I am indebted to Dr. D. G. Elliot for the following notes on the former abundance of sheep in the southern part of Yale County, British Columbia.

"In 1886 I made a hunting trip in British Columbia after mountain sheep. Starting from Hope on the Fraser River, I crossed a portion of the Coast Range into Ashnola, and under Indian guidance proceeded to a mountain called by the natives "Ka-Asch-Ho," where our camp was pitched. At that time there had been but little or no hunting in that part of the country as it was not easy of access, and great numbers of sheep and mule deer frequented the district. The mountain, on which our hunting was done, had many more or less flat stretches on it, some of considerable extent, so that it was possible to ride a horse over most of it. The sheep, not having been much disturbed, were not particularly shy and it was possible to approach quite close to bands of considerable size without alarming them or causing them to move away to any distance. The old rams had not yet joined the ewes, but kept by themselves in companies of five to eight, while the large bands were composed of ewes, young rams and lambs.

"To illustrate how plentiful the sheep were at this period in that locality, the following incident will show. I had been hunting one morning without meeting any rams carrying horns sufficiently large to be considered a worthy trophy, when about eleven o'clock I reached a hog-back having quite a sharp ridge and which dropped down in a graded descent to the plain or wide valleys on either side. I sat down on the edge and was surveying the country and other ridges below me, when I heard sounds as if some metal had struck a stone sharply on the side of the hog-back away from me. I kept perfectly still and soon was able to distinguish the unmistakable sound of small hoofs striking against small stones. In a few moments, not more than seventy-five feet from where I sat, the horns and then the head and body of an old ewe appeared and crossed the top of the hog-back and began to descend the side on which I sat. This leader was closely followed by a crowding company of ewes, lambs and young lambs. If they saw me, they paid no attention to my presence, as I kept perfectly still in hope that a head would appear with sufficiently large horns to be worth obtaining. The procession of animals continued to pass over the ridge until I estimated that at least one hundred and fifty had crossed, but without any head appearing worth securing, so I sat and watched them descend slowly the steep side to the valley below. On other days however I obtained specimens, and the head of a ram and ewe are still in my possession.

"These sheep on Mt. Ka-Asch-Ho seemed to be rather local in their habitat, for so far as I could learn at the time from the Indians, they were not to be found farther north in the Range, and of course if they did go as far as the Fraser, that river would be an insuperable bar to their farther progress unless far up towards its head waters. After we had left the Ashnola Country, the news of our successful hunt became bruited about and many hunters went to the sheep mountains and in a few seasons the animals were compelled to seek a safer retreat and all or nearly all left the locality."

2. **Ovis cervina californiana** *Douglas.*

Ovis californianus Douglas, Zool. Journ., IV, p. 332, Jan. 1829. Specimen described (type) from near Mount Adams; said to occur in the Cascades and "in the mountainous districts of California."

Ovis californica Richardson, Faun. Bor.-Amer., I, 1829, p. 272 (a passing reference in the text, identifying it with "Piccolo's sheep)."

Ovis californiana Blyth, Proc. Zool. Soc. London, 1840, pp. 65, 67; Ann. and Mag. Nat. Hist., VII, 1841, pp. 199, 260, pl. v, fig. 5, horns. Recognized as a good species.— Biddulph, Proc. Zool. Soc. London, 1885, p. 683. Name, *O. californianus* Douglas rejected, owing to an error in the length of the tail as given by Douglas.

Ovis montana Kennerly, P. R. R. Expl. and Surv., X, pt. 6, 1859, p. 72. Abundant on Mount Shasta, and evidence of its habitual presence in the vicinity of Rhett and Wright Lakes, northern California.— Suckley and Gibbes, P. R. R. Expl. and Surv., XII, 1860, p. 137. Mt. Hood, Oregon; Mt. Shasta and eastward in California.

Ovis canadensis Merriam, N. Amer. Fauna, No. 16, p. 103, Oct. 28, 1899. Evidence of its recent occurrence at Mt. Shasta.— Stephens, California Mamm., 1906, pp. 57, 58. "Formerly found in parts of the Sierra Nevada and on Mt. Shasta, but they are apparently now exterminated in those mountains."

Ovis cervina, Elliot, Synop. N. Amer. Mamm., 1901, p. 46, part.

Type locality, near Mount Adams, Yakima County, Washington.

Range. Formerly the Cascade Mountains of southern Washington and Oregon, and Mount Shasta and the mountainous country to the eastward in northern California; now probably extinct.

3. **Ovis cervina auduboni** *Merriam.*

Native Species of Sheep Barton, Med. and Phys. Journ., I, 1804, pp. 75–77, II, 1805, pp. 106–113. Contains probably the earliest references to the sheep of the

Upper Missouri country. Supposed to be the Argali of Asia, and also identified with the Taye of Piccolo and Venegas.

Ovis montana BAIRD, P. R. R. Expl. and Surv., VIII, 1857, pp. 673–679, figs. 24–32, part.— ALLEN, Proc. Boston Soc. Nat. Hist., XVII, Oct. 1874, p. 48 (badlands of the Yellowstone River). GRINNELL, Ludlow's Recon. Black Hills of Dakota, 1875, p. 84 (Little Missouri River).

Ovis cervina ALLEN, Bull. Amer. Mus. Nat. Hist., VII, p. 263, Aug. 21, 1895, (Black Hills region, South Dakota).

Ovis canadensis auduboni MERRIAM, Proc. Biol. Soc. Washington, XIV, p. 31, April 5, 1901. Based on skulls from the badlands of South Dakota.

Type locality, badlands between the White and Cheyenne Rivers, South Dakota.

Range. Badlands of the Yellowstone and Missouri Rivers in eastern Montana, eastern Wyoming, North and South Dakota, and western Nebraska. Probably now extinct over most of this area.

4. **Ovis cervina mexicana** *Merriam.*

Ovis mexicanus MERRIAM, Proc. Biol. Soc. Washington, XIV, p. 30, April 5, 1901. — BAILEY, N. Amer. Fauna, No. 25, pp. 70–75, Oct. 25, 1905 (western Texas). — HORNADAY, Fifth Ann. Rep. New York Zool. Soc. (1900), June 1, 1901, pp. 120–122 (description, from Merriam).

Ovis cervina mexicanus ELLIOT, Mamm. Middle Amer., 1904, p. 86; Check List Mamm. N. Amer., 1905, p. 54.

Ovis canadensis mexicanus LYDEKKER, Great and Small Game of Europe, Asia and America, 1901, p. 11 (from Merriam).— MEARNS, Mamm. U. S. and Mex. Bound. Surv., I, 1907, pp. 232–239 (range and relationships).

Type locality, Lake Santa Maria, Chihuahua, Mexico.

Range. Mountains of northern Chihuahua, extreme western Texas, southern New Mexico, and southern Arizona.

5. **Ovis cervina nelsoni** *Merriam.*

Ovis nelsoni MERRIAM, Proc. Biol. Soc. Washington, XI, pp. 217–218, July 15, 1897 (original description; Grapevine Mountains, boundary between California and Nevada.— HORNADAY, Fifth Ann. Rep. New York Zool. Soc. (1900), June 1, 1901, pp. 117–119 (description and distribution).

Ovis cervina nelsoni ELLIOT, Synop. Mamm. N. Amer., 1901, p. 46; Check List Mamm. N. Amer., 1905, p. 54.

Ovis canadensis nelsoni LYDEKKER, Wild Oxen, Sheep, and Goats, 1898, p. 208 (from Merriam); Great and Small Game of Europe, Asia and America, 1901, p. 10 (from Merriam).— STEPHENS, California Mamm., 1906, pp. 58, 59 (general account and range).— MEARNS, Mamm. U. S. and Mex. Bound. Surv., I, 1907, pp. 245–247 (detailed account and range).

Type locality, Grapevine Mountains, on the boundary of southern Nevada and California.

Range. Mountains of southern Nevada, southern California, and northern border of Lower California.

6. **Ovis cervina gaillardi** *Mearns.*

Ovis montana BAIRD and SCHOTT, Mex. Bound. Surv., pt. 2, Zool., 1859, p. 52. "Rocky waterless sierras of northwestern Sonora and New Mexico" (= southwestern Arizona).

Ovis canadensis gaillardi MEARNS, Mamm. U. S. and Mex. Bound Surv., I, 1907, pp. 240–244, figs. 35–39 (original description).

Type locality, Gila Mountains, between Tinajas Altas and the Mexican boundary line in Yuma County, Arizona.

Range. Mountains of northwestern Sonora and southwestern Arizona.

7. **Ovis cervina cremnobates** *Elliot.*

Taye of the Monqui Indians PICCOLO, Phil. Trans., XXVI, No. 318, 1708, p. 336 (English transl., original not seen); Jones's Abridged Phil. Trans., V, 1731, pt. 2, p. 194 (same as the above); Baddam's Abridged Phil. Trans., V, 1740, p. 156 (same as the two above cited). These English translations have been repeatedly cited.

The Taye, or California Deer VENEGAS, "Noticias de la California, 1758" (not seen; usually cited from the English ed.: Nat. and Civ. Hist. California, I, 1759, pp. 36, 37, pl. facing p. 36, lower fig. Based on Piccolo's account, of which it is a paraphrase, but is the source usually cited for Taye. Its noteworthy feature is the plate, well reproduced in 'Forest and Stream,' Oct. 29, 1910, p. 593. Also here shown in Fig. 4.

Ovis cervina cremnobates ELLIOT, Field Columbian Mus., Zool. Ser., III, No. 14, pp. 239–241, 2 figs., Dec., 1903; Mamm. Middle Amer., 1904, p. 84, figs. xxvi, xxvii; Check List Mamm. N. Amer., 1905, p. 54.

Type locality, Mattomi, San Pedro Martir Mountains, Lower California.

Range. Mountainous parts of Lower California, from Satillo del Rey northward, especially on the Gulf side, nearly to the United States boundary.

B. Ovis dalli Group.[1]

8. **Ovis dalli dalli** *Nelson.*

Small White Buffaloes MACKENZIE, Voyages from Montreal through the Continent of North America, English ed., I, 1802, pp. 202, 239; Amer. ed., 1802, pp. 29, 36.

Ovis montana RICHARDSON, Faun. Bor.-Amer., I, 1829, p. 271, pl. xxiii (part, the male only).

Ovis montana dalli NELSON, Proc. U. S. Nat. Mus., VII, 1884, p. 12 (original description).

Ovis dalli ALLEN, Bull. Amer. Mus. Nat. Hist., XII, p. 3, March 4, 1899 (Nahanna Mts.; measurements).— STONE, Bull. Amer. Mus. Nat. Hist., XIII, pp. 43–47, April 6, 1900 (distribution and habits).— PREBLE, N. Amer. Fauna, No. 27, p. 157,

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[1] On the *Ovis dalli* group see Hornaday, Fifth Ann. Rep. New York Zool. Soc. (1900), June 1, 1901, pp. 77–100, with illustrations; Sheldon's 'The Wilderness of the Upper Yukon: A Hunter's Explorations for Wild Sheep,' New York, 1911. Sheep *passim*, and especially Chapter XX, with colored map of distribution and illustrations of color phases.

Oct. 26, 1898 (range; male of *O. montana* Richardson referred to *O. dalli*).— HORNADAY, Fifth Ann. Rep. New York Zool. Soc. (1900), June 1, 1901, pp. 80–96, 8 half-tone figs. (description, distribution, habits, color of type specimens, etc.).

Ovis canadensis dalli NELSON and TRUE, Nat. Hist. Collections from Alaska, 1887, pp. 282–284 (measurements, distribution, habits).— MCCONNELL, Ottawa Nat., VI, No. 8, Dec., 1892, pp. 131, 132 (distribution and color variation).— LYDEKKER, Wild Oxen, Sheep, and Goats, 1898, pp. 219–221 (general account); Great and Small Game of Europe, Asia and America, 1901, p. 15, pl. i, fig. 3.

Ovis cervina dalli ELLIOTT, Synop. Mamm. N. Amer., 1901, p. 47; Check List Mamm. N. Amer., 1905, p. 55.

Type locality, near Fort Reliance, Yukon.

Range. Greater part of Alaska and Yukon, and southeastward in the Mackenzie Mountains.

9. **Ovis dalli kenaiensis** *Allen.*

Ovis dalli OSGOOD, N. Amer. Fauna, No. 21, p. 62, Sept. 26, 1901 (Cook Inlet region, Alaska).

Ovis dalli kenaiensis ALLEN, Bull. Amer. Mus. Nat. Hist., XVI, pp. 145–148, figs. 1, 2, Apr. 23, 1902 (Kenai Peninsula, Alaska; original description); *ibid.*, XX, p. 227, Nov. 4, 1904 (Kenai Peninsula).— ELLIOT, Check List Mamm. N. Amer., 1905, p. 55.

Type locality, Sheep Creek, Kenai Peninsula, Alaska.

Range. Kenai Peninsula, Alaska.

10. **Ovis dalli stonei** *Allen.*

Ovis montana RICHARDSON, Faun. Bor.-Amer., I, 1829, p. 271, pl. xxiii, (part, the female only).

Ovis stonei ALLEN, Bull. Amer. Mus. Nat. Hist., IX, pp. 111–114, pll. i, ii, Apr. 8, 1897 (original description); *ibid.*, XII, p. 2, March 1, 1899 (Nahanna Mts.)— STONE, *ibid.*, XIII, p. 42, April 6, 1900 (range and habits).— PREBLE, N. Amer. Fauna, No. 27, p. 156, Oct. 26, 1908 (*O. liardensis* considered a synonym of *O. stonei*; female of *O. montana* Richardson referred to *O. stonei*).— HORNADAY, Fifth Ann. Rep. New York Zool. Soc. (1900), June 1, 1901, pp. 97-100, 3 half-tone cuts (detailed description and figures).

Ovis canadensis stonei LYDEKKER, Wild Oxen, Sheep, and Goats, 1898, p. 217–219 (general account); Great and Small Game of Europe, Asia and America, 1901, pp. 12–15, text figs. 2, 3, pl. i, fig. 1 (additional matter).

Ovis liardensis LYDEKKER, Wild Oxen, Sheep, and Goats, 1898, p. 215, fig. 41. Type from "Liard River." Later (Great and Small Game of Europe, Asia and America, 1901, p. 12) referred by him to *Ovis stonei*.

Type locality, Cheeonnee Mountains, northern British Columbia.

Range. Northern British Columbia, east of longitude 130° W.; further north merges into the *fannini* type.

11. **Ovis dalli fannini** *Hornaday.*

Saddle-backed Sheep MCCONNELL, Ottawa Nat., VI, No. 8, Dec., 1892, p. 131, in text (Upper Yukon River, N. W. Terr.).

Ovis fannini HORNADAY, Fifth Ann. Rep. New York Zool. Soc. (1900), June 1, 1901, pp. 78–81, 5 half-tone pll., 1 map (original description).

Ovis canadensis fannini LYDEKKER, Great and Small Game of Europe, Asia and America, 1901, pp. 19–21 (suggests it may be a hybrid between *dalli* and *stonei*).

Type locality, near Dawson City, Yukon.

Range. Mainly between latitude 58°–64° north, and between longitude 129°–135° west, in British Columbia and Yukon, gradually merging in the south with *O. dalli stonei*, and west and north with *O. dalli dalli*. (See Sheldon, *op. cit.*)

59.9.82A

Article II.—NEW SPECIES OF MONKEYS OF THE GENERA *SENIOCEBUS*, *ALOUATTA*, AND *AOTUS*.

By D. G. Elliot, D. Sc., etc.

Seniocebus meticulosus sp. nov.

Type locality. River San Jorge, Northern Colombia.

Genl. Char. Head and ears naked; no orange rufous on underparts; rump, root of tail and thighs bright bay. Posterior molar the smallest.

Color. Male. Face and forehead covered with short white hairs; top of head and nape covered with very long white hairs, forming a high crest on the head, and flowing over the back between the shoulders; rest of head, ears and throat naked, black; upper parts to rump dark drab; flanks paler, the hairs on the latter as well as those between the shoulders tipped with white; hairs on upper arms and shoulders from roots bright bay, with terminal third drab and tips white; thighs, rump at root of tail, and hind side of legs bright bay; rest of legs, arms, inner side of limbs, and entire under parts silvery white; hands and feet grayish white; tail above bright bay on basal third, the same color extending for half the length on under side, remainder jet black.

Measurements. Total length, 660.5 mm.; tail, 400; foot, 80. Skull: total length, 49; occipito-nasal length, 46.2; Hensel, 30.3; zygomatic width, 32; palatal length, 14.4; intertemporal width, 23.1; median length of nasals, 60.7; length of upper molar series, 90.5; length of mandible, 30; length of lower molar series, 12.

Female. Resembles the male, except there is very little of the bright bay color on the shoulders and rump, while the thighs are colored like the upper parts, dark drab, the hairs tipped with bay. Tail like that of the male.

Two examples of this handsome little monkey, the third species known of the genus, were received at the American Museum of Natural History in New York from Mrs. E. L. Kerr, who procured them in the forest on the River San Jorge, Colombia. While bearing in some of its coloration a resemblance to the species known for so long a time from Brazil, *S. bicolor*, the bright bay rump and thighs, pure silvery white under parts and inner side of limbs, and grayish white hands and feet of this species cause it to differ in a conspicuous manner from its relative. The lately described *S. martinsi* (Thomas), is the third known member of the genus.

The species of this genus are very rare in collections, and I am not aware that there is another example belonging to it contained, at the present time, in any other Museum in the United States. We are much indebted to Mrs. E. L. Kerr, who obtained these specimens, for the energy and perseverance she has displayed.

Alouatta ululata sp. nov.

Alouatta discolor Dollm. (nec Spix). Ann. Mag. Nat. Hist. (8), VI, 1910, p. 422.

Type locality. Miritibi, Maranhao. Type in British Museum.

Geogr. Distr. Lower Amazon; Maranhao, Brazil.

Genl. Char. Sexes unlike; male with chestnut red back, female raw umber.

Color. Male. Forehead, and whiskers extending beneath chin, black; top of head brownish black; arms, hands, feet, rump, and outer side of legs black; indistinct blackish stripe on middle of back; rest of upper parts and flanks rich chestnut red, in certain lights suffused with a golden color; upper edge of thighs chestnut red; forearms beneath black; rest of underparts and limbs beneath nude; fingers and toes covered with long yellowish red hairs; tail black with numerous golden red hairs intermingled; tip chestnut red like flanks. Ex type in British Museum.

Female. Tuft above middle of forehead, and whiskers black; top and sides of head above ears, upper part of body and flanks raw umber, with a golden tinge on head, and an indistinct dark dorsal line; arms black with a strong olive tinge; legs similar but paler; hands similar to arms, but hairs grading at knuckles, and extending over fingers, yellowish gray; feet more golden red, and toes golden yellow; tail like legs at base grading to a mixed golden red and black, with the tip golden red. Body and limbs beneath, naked. Ex type in British Museum.

Measurements. Male. Total length, 1145 mm.; tail, 585; foot, 140. (Skin.) Skull: total length, 120.6; occipito-nasal length, 101.4; Hensel, 104.3; zygomatic width, 78.4; breadth of braincase, 52.4; palatal length, 47.7; median length of nasals, 25.5; length of upper molar series, 33.5; length of mandible, 95.1; length of lower molar series, 40.5. Ex type in British Museum. The above descriptions were taken from specimens loaned to me by my friend Guy Dollman, Esq., of the British Museum, and received from Miritiba, Maranhao, Brazil.

Specimens of this monkey were received at the British Museum representing both sexes and were supposed by Mr. Dollman to be the long lost *Mycetes discolor* Spix, and were so described by him under that name (*l. c.*). Spix's figure and his description do not agree, and the latter cannot be strictly applied to any species of *Alouatta* known. The figure represents an immature male, probably of *A. belzebul* Linn., as it came from near Para where Linnæus's species is found, as Spix says of his *discolor*: "Habitat in sylvis ripariis fluminis Amazone nec non Tocantins prope urbem Para." *A. ululata* is a handsomer and more brilliantly colored species than *A. belzebul*, and differs from it in its chestnut red upper parts, flanks, and upper edge of thighs, and black hands and feet.

Spix's type of *A. discolor* is in the Munich Museum, and is a rather small, uniformly glossy black monkey, with a very faint brownish hue on the flanks, and the fingers, toes and tip of tail pale rusty red, evidently a young male of *A. belzebul* (Linnæus).

Aotus griseimembra sp. nov.

Type locality. Hacienda Cincinnati, Santa Marta, Colombia. Type No. 32664, American Museum of Natural History, ♂ ad., collected by M. A. Carriker, Jr., July 20, 1911.

Color. Spot above and below each eye white; a black patch beginning at a point on forehead between each eye and extending backward on crown, fan-shaped; jet black line extending from each eye on side of head and going to occiput; rest of head, neck and upper parts mixed cinnamon and black; arms and legs smoke gray, hairs tipped with buff, no cinnamon or black present; hands mummy brown and black; feet black on sides, golden brown on center and on toes; sides of head and neck grayish; throat buff; rest of under parts and inner side of arms and thighs ochraceous buff; flanks grayish buff; tail at root above like upper parts, mixed black and cinnamon, beneath at root dark ochraceous rufous, sides on basal half buff, hairs black tipped; rest of tail jet black.

Measurements. Total length, 1047 mm.; tail, 372; foot, 92.5 (Collector). Skull: total length, 60; occipito-nasal length, 58.02; zygomatic width, 36.05; intertemporal width, 32; median length of nasals, 11; breadth of braincase, 32; palatal length, 16.04; length of upper molar series, 13.05; mandible, 35; length of lower molar series, 15.03.

This species, while resembling somewhat *A. vociferans*, differs in being darker on the upper parts and especially in the gray arms and legs, the hairs buff tipped. Two examples, both males, were collected by Mr. M. A. Carriker, Jr., in the mountains near the coast of Santa Marta, Colombia.

59.7,38 C:15.6

Article III.— ORTHOGENESIS IN THE EGG CAPSULES OF CHIMÆRA.

By Bashford Dean.

The egg capsules of Chimæroids, even of the common species, are rare objects in collections. The museum is accordingly greatly indebted to Professor H. F. E. Jungersen of the Zoölogical Department of the University of Copenhagen, for the gift of one of these capsules, of a kind, moreover, which has not been recorded. It was "dredged in the North Atlantic from great depths," but unfortunately the station is not known.

Up to the present the egg-capsules of four species of Chimæra have been described, *C. colliei, monstrosa, phantasma,* and *mitsukurii.* Of these the present specimen resembles most closely the egg-case of the last mentioned species. It is a fair inference, therefore, in view of the ultra specialization of these capsules, that the parental fishes were similar, and in this event we may provisionally assign the present capsule to *C.* (*Bathyalopex*) *mirabilis* (Collett),[1] a Chimæra recently described from the same general region in which this capsule was dredged. (Fig. 1.)

Comparison of the present capsule with those of other Chimæras may be given in tabular form on p. 37.

Interpreting the foregoing results one observes that in certain regards, as in *C. mitsukurii,* the present capsule is highly specialized: it is remarkable in the slenderness of its trunk-sheath in terms of the entire length: in the great length of its tail-sheath and of its opening valve: and in its very numerous respiratory openings along the tail-sheath. In addition to these features we note that the marginal web, so conspicuous in *colliei* and *monstrosa,* has undergone great reduction, about indeed as in *mitsukurii,* and is represented at the best by small flaring barbs at the extreme anterior end: also that the dorsal keel of the capsule is very low, and that the "teeth" on the anterior rim of the valve are specialized anteriorly into long and delicate processes, more exaggerated in regional differentiation than in the capsules of other species.

In certain regards, therefore, the present specimen is the most specialized capsule known in chimæroids, and possibly,[3] judging from the number and

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[1] Collett, Forh. Vid. Selsk. Christiania, 1904, No. 9, p. 5, and 1905, Report on Norwegian Fishery and Marine Investigation, Vol. II, No. 3, p. 35, pl. I.

[2] Dean, Chimæroid Fishes and their Development. 1906, Carnegie Institution, p. 30.

[3] Dean, 1904, Biol. Bull., Vol. VII, pp. 105–112; Amer. Naturalist, Vol. XXXVIII, pp. 486–487.

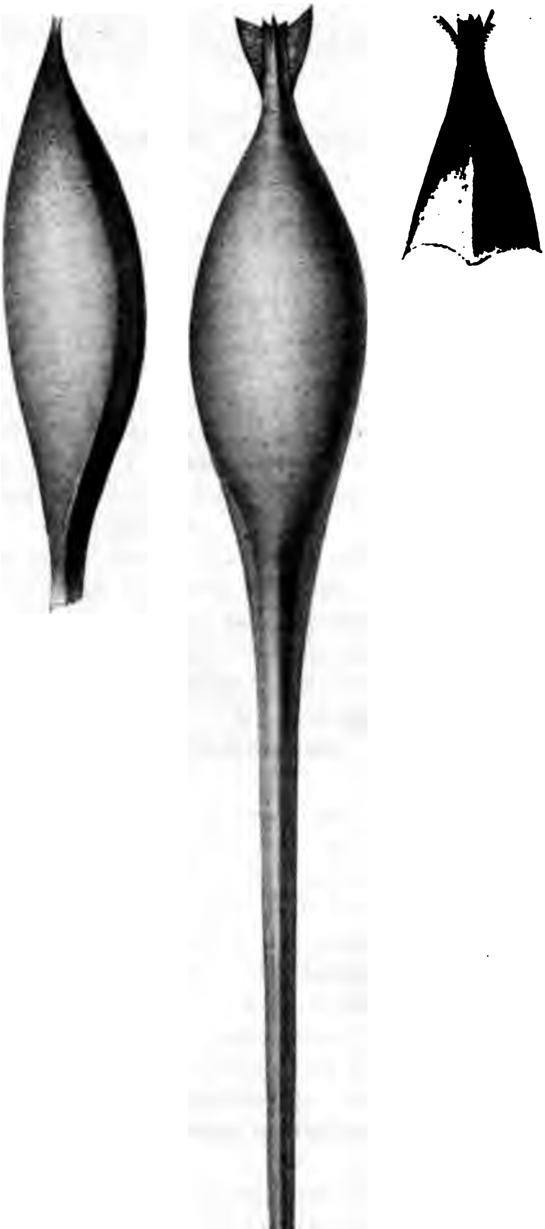

Fig. 1. Egg-capsule of a North Atlantic Chimæroid, probably *Chimæra* (? *mirabilis* (Collett). Natural size, shown in lateral, ventral and dorsal aspects.

Length of Capsule. (cm.)	Genus Chimaera, Species	Percentage of breadth to length: Breadth of trunk sheath only	Percentage of breadth to length: Breadth, measured between bases of lateral web	Percentage of tail sheath to entire length.	Proportional length of opening valve from hinge to anterior end of capsule (i. e. in percentage of total length of capsule.)	Number of respiratory openings along each side of opercular valve.	Number of respiratory (couples of) openings in caudal-sheath	Proportional length of rim of operculum bearing serrations (actual), i. e. in percentage of total length of capsule	[illegible], number of
15–17	colliei	14–17	18	43	33 37	36 + many (30) rudimentary pores.	90	10 beginning in front	35
17	monstrosa	17	15	54	16	50 very small.	75	6 " "	—
27	phantasma	26	22[1]	63	18	54 —30 rudimentary pores	62	5.5 " "	
22	mitsukuri	22	12	56	70[3]	24	300—	5— " "	—
17	? Bathyalopex mirabilis Jungersen's capsule	14	10	64		35	110	6— " "	—

range of its structures, the most specialized hitherto described among all animals.

In a final note we suggest the lines of the evolution of the capsules of Chimaeras:

If we compare the known egg capsule of various species of chimaeroids, we find that with slight simplifications, they arrange themselves in a series somewhat as shown in Fig. 2 in the order B, C, D, E, forms which typify recent species. In this series, on account of the reduction of the marginal web of the capsule, the extraordinary development of its caudal sheath and the huge size of the opening valve, we are led to conclude that the form E is more specialized than the form B. Interpreting this result evolutionally, we are warranted in assuming that the species of Chimæra which had oviducal structures of such a nature as to produce the capsule E, was descended from species of Chimæra whose structures in turn produced capsules not unlike those of D, C, and B. All of this follows clearly from the evidence of the capsules themselves, *i. e.*, without collateral evidence as to chimæroid descent. We may go so far, I believe, as to assume on this evidence that the capsule B was represented in a still older (ancestral) form by the hypothetical capsule A, and that the form E predicates oviducal structures of a form which may be expected to give rise to the hypothetical capsule F. In fact, encouraged by the findings of recent years, we suggest the probability that these two types of capsules will eventually be discovered.

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[1] There is an apparent contradiction between these figures and the proportional breadth of the trunk sheath — that is the entire breadth of the capsule is apparently less than the breadth of the trunk sheath. This is due to the fact that the 'breadth' is intended to mean the widest distance from lateral web-tip to lateral web-tip. This is in certain cases less than the entire breadth of the trunk sheath, since the ventral region of the capsule often enlarges in an extraordinary way.

[2] Proof error in earlier paper — [illegible] instead of [illegible].

[3] This great percentage is doubtful. In the single specimen available the hinge was not well shown, and it may have been torn through.

It is an interesting fact that the capsule suggested in A is similar to the type of capsule which occurs in the neighboring chimæroid family Callorhynchidæ. And it is also pertinent to observe that there are many reasons, anatomical, embryological and palæontological, for regarding *Callorhynchus*[1] as similar to the ancestor of the Chimæridæ. Accordingly it is by no means illogical to consider such a capsule as A as representing the earliest "Chimæra."

If now we review the capsular structures of the various species of Chimæra, we are impressed with the fact that the series falls into a "direct line" (orthogenetic). In this series of capsules we note that:

I. The lateral web becomes reduced and obsolescent: its most conspicuous rudiment appearing at the capsule's anterior end.

II. The dorsal web undergoes a similar reduction.

III. The body-sheath becomes shorter, and the tail-sheath of the capsule proportionately longer and narrower.

IV. The exit-valve of the capsule increases in length. At first (C) it becomes actually shorter, but not relatively, *i. e.*, in terms of the length of the body-sheath.

V. The serrated portion of the edge of the valve becomes constantly reduced in length (and the individual serrations in general more conspicuous).

VI. The line of respiratory apertures on the sides of the caudal sheath becomes lengthened.

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[1] The capsule of *Callorhynchus*, it may be recalled, corresponds more closely with that of sharks, which in general, on grounds anatomical, embryological and palæontological, are shown to be more primitive than chimæroids. *Cf.* Dean, Carnegie Memoir already cited.

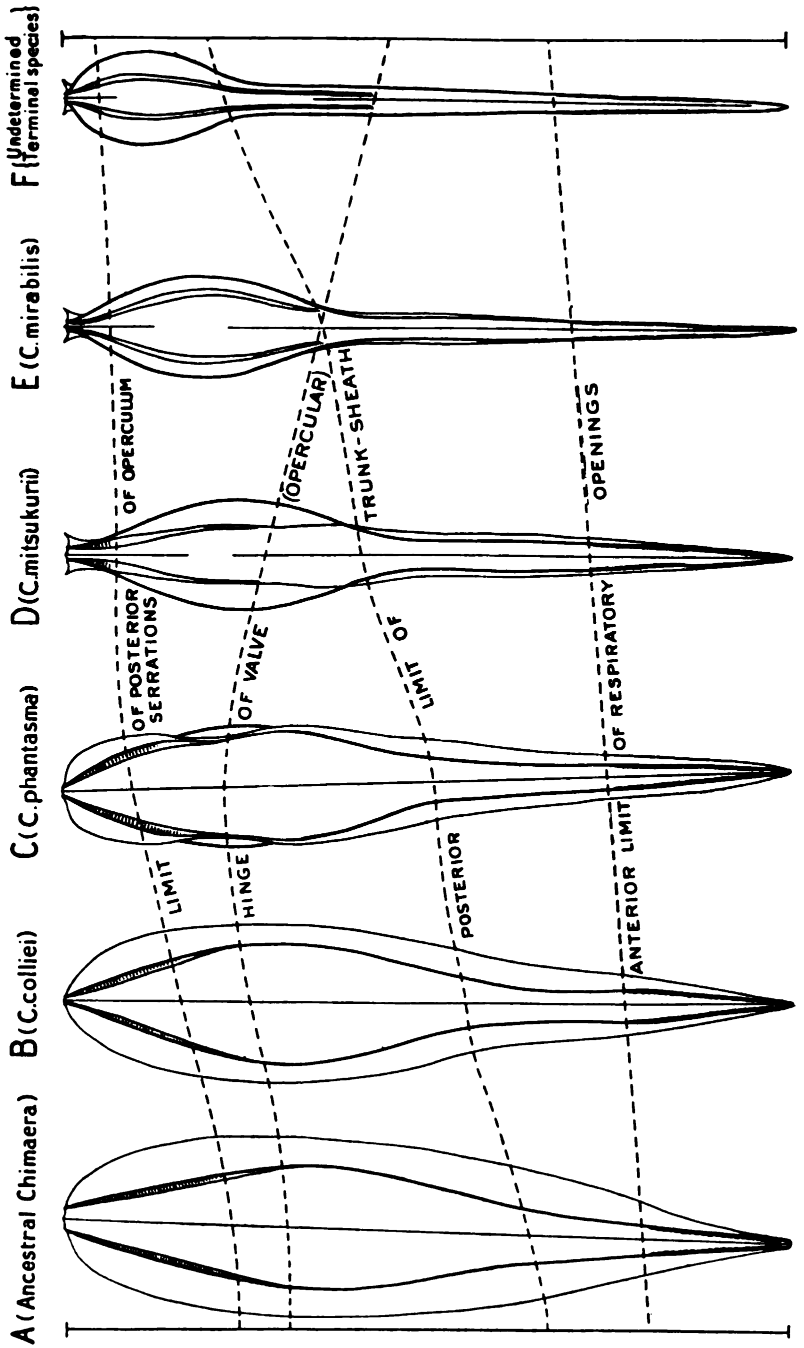
A (Ancestral Chimaera)
B (C. colliei)
C (C. phantasma)
D (C. mitsukurii)
E (C. mirabilis)
F (Undetermined (Terminal species)
LIMIT OF POSTERIOR SERRATIONS OF OPERCULUM
HINGE OF VALVE (OPERCULAR)
POSTERIOR LIMIT OF TRUNK-SHEATH
ANTERIOR LIMIT OF RESPIRATORY OPENINGS

Fig. 2. Egg-capsules of Chimæroids (B–E), arranged in orthogenetic series. At each end of this series an hypothetical form is indicated (A and F).

The character of the changes which here are indicated, are certainly definite in their direction; and it is significant that this serial arrangement in the capsules accompanies a similar serial arrangement in at least the external characters of the adult Chimæras. It is thus an orthogenetic series narrowly defined. It cannot be explained on grounds of natural selection, for the reasons which we have already enumerated,[1] unless indeed, one can, following the recent admissions of Weismann, regard selection as an impersonal process conditioned by "alterations in the equilibrium of the determinant system," and having a "quite definite direction persisted in for internal reasons." However the variations occurred (*e. g.*, mutational) which produced the foregoing result we must nevertheless admit that they have expressed themselves orthogenetically.

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[1] Biol. Bull., Vol. VII, 1904, pp. 105–112.

56.57,68R(118:78.8)

Article IV.—ON SOME FOSSIL RHYNCHOPHOROUS COLEOPTERA FROM FLORISSANT, COLORADO.

By H. F. Wickham.

Plates I–IV.

The beetles treated in the following report form part of a collection made by parties under the direction of Prof. T. D. A. Cockerell. They have been transmitted to me for study by the American Museum of Natural History and the specimens are divided between that institution and the University of Colorado.

This paper is one of a series intended to elucidate the fossil Coleopterous fauna of Florissant, with the ultimate aim of working out all of the accessible collections and thereby putting our knowledge of the beetle life of that place and time in such shape as to make it available for comparison with modern or other ancient faunæ. While Dr. Scudder has described 116 species of Rhynchophora from these shales, the field was not exhausted even in that group, since my studies of smaller series, mostly collected by Prof. Cockerell's parties, have increased the number of known forms by about twenty per cent. In the non-Rhynchophorous families the proportion of novelties will be enormously greater, as Dr. Scudder had only begun their study.

A few words should be said regarding the descriptions and the plates. In citing specimens I have spoken of them as paired when both sides, obverse and reverse, were shown. In such cases, the insect was, of course, represented upon two stones. When only one stone, which shows but one view of the insect, was present, I have spoken of the specimen as single. As to the figures, they are all from my camera lucida drawings and are intended to show the outlines and proportions. Where the sculpture is shown, this also is put in with the camera lucida, but it will be seen that in many instances the figures are drawn to illustrate the courses of sculptured markings and not to give views of the minuter modifications. Detail views are furnished for many of the microscopical characters, and attention has been called, in the proper places, where striæ or similar structures have been diagramed. Advantage has been taken of this opportunity to figure some Rhynchophora described in Vol. XXX of this Bulletin, pages 63 to 69.

Arranged by families, the species herein reported upon are as follows:

RHYNCHITIDÆ.

Masteutes saxifer *Scudd.*
Eugnamptidea tertiaria n. sp.
Isothea alleni *Scudd.*
Docirhynchus terebrans *Scudd.*
“ culex *Scudd.*
Toxorhynchus minusculus *Scudd.*
“ grandis *Wickh.*

OTIORHYNCHIDÆ.

Ophryastites miocenus n. sp.
“ cinereus *Scudd.*
Ophryastes championi n. sp.
Otiorhynchites florissantensis *Wickh.*
Cyphus subterraneus *Wickh.*

CURCULIONIDÆ.

Geralophus antiquarius *Scudd.*
“ occultus *Scudd.*
“ scudderi *Wickh.*
“ saxuosus *Scudd.*
“ fossicius *Scudd.*
“ repositus *Scudd.*
“ lassatus *Scudd.*
“ pumiceus *Scudd.*
“ retritus *Scudd.*
Coniatus differens n. sp.
Apion confectum *Scudd.*
Apion exanimale *Scudd.*
“ refrenatum *Scudd.*
Cleonus estriatus n. sp.
“ rohweri *Wickh.*
“ primoris *Scudd*
“ foersteri *Scudd.*
“ degeneratus *Scudd.*
Dorytomus vulcanicus n. sp.
Magdalis striaticeps *Wickh.*
Anthonomus rohweri n. sp.
Sibynes whitneyi *Scudd.*
Conotrachelus florissantensis n. sp.
Cryptorhynchus coloradensis n. sp.
“ fallii n. sp.
“ kerri *Scudd.*
Baris hoveyi n. sp.
“ schucherti n. sp.
“ matura *Scudd.*
Balaninus extinctus n. sp.
“ restrictus *Scudd.*
“ minusculoides *Wickh.*
“ minusculus *Scudd.*

CALANDRIDÆ.

Scyphophorus fossionis *Scudd.*

ANTHRIBIDÆ.

Cratoparis adumbratus *Wickh.*

Masteutes *Scudd.*

M. saxifer *Scudd.* This species is represented by a fine specimen, showing obverse and reverse, collected at Station number 14, by Mrs. W. P. Cockerell.

Eugnamptidea n. gen.

Form similar to *Eugnamptus*, but differs in the antennæ having a four-jointed club. Other characters are wanting, but the above will amply distinguish it.

E. tertiaria n. sp. (Plate IV, Figs. 9 and 10.) Form moderately elongate, apparently about as in the recent *Eugnamptus angustatus*. Head rather long, but not quite equal to the prothorax, rather coarsely punctate immediately behind the eye, occipital and genal regions strongly but finely transversely striate. Beak about as long as the prothorax, slightly roughened and with a fine lateral stria or carina, slightly arcuate, the extreme tip broken off. Eye large. Antenna long, slender, eleven-jointed, joints 1 to 6 subequal, seventh distinctly shorter, the remaining four forming a loose slender club as shown in the figure, the tip of the last joint obscured. Prothorax short, discal region rather strongly moderately coarsely and fairly closely beset with circular punctures which become confluent and somewhat smaller on the sides. Elytra visible only at the edge where two rows of strong large circular punctures are seen, those of each row closely approximate but the rows themselves distant about the diameter of the punctures. Abdomen showing four subequal segments separated by nearly straight sutures, the extreme tip broken off. Sculpture of the underside obscure, apparently only a slight roughening or scabrosity. Length, from front of eye to broken tip of abdomen, 2.50 mm.

Station number 14. Collected by S. A. Rohwer. The type is in the American Museum of Natural History.

The antenna of this insect is most remarkable and will at once separate it from any weevil with which I am acquainted. It belongs to the Rhynchitidæ, however, by all the other characters of structure and facies that can be made out. None of the species described by Dr. Scudder approach it very closely though the form is similar to some of them, notably *Isothea.* The antennæ of *I. alleni* as figured on the whole specimen have a four or five jointed club, but Dr. Scudder gives a very circumstantial account in which the club is said to be composed of joints 9 to 11, and in his detail figure it is so drawn.

Isothea *Scudd.*

I. alleni *Scudd.* Represented by one single and one paired specimen collected at Station number 14 by Geo. N. Rohwer, and by a very poor example from Station number 9 collected by S. A. Rohwer.

Docirhynchus *Scudd.*

D. terebrans *Scudd.* A good specimen comes from Station number 14, where it was collected by S. A. Rohwer. The head and beak together are not as long as the elytra in this example, which agrees with Scudder's figure in this respect, although in his description the conjoint length of the first two parts is said to be equal to the third. Two other specimens are referred here, one of them having been taken at Station number 14 by Prof. Cockerell, the other at Station number 17B by Mrs. Cockerell.

D. culex *Scudd.* Represented by two paired and two single specimens, all from Station number 14, where they were collected by S. A. Rohwer and Mrs. Cockerell. I have allowed for some slight variation in the length of the beak in this species, which seems to differ from *D. terebrans,* aside from the rostral structure, chiefly in having a smooth prothorax and in being a trifle larger.

Toxorhynchus *Scudd.*

T. minusculus *Scudd.* Ten single specimens and four pairs come from Station number 17, and two pairs from Station number 17B. The examples agree with Scudder's description and figure in form, size and the characteristic coarse thoracic sculpture. They show the beak to have been nearly straight and about as long as the prothorax.

T. grandis *Wickh.* (Plate III, Fig. 5.) This species was not figured at the time of the publication of the original description, and advantage is taken of the present opportunity to offer a camera lucida drawing which will show the form and the elytral sculpture.

Ophryastites *Scudd.*

O. miocenus n. sp. (Plate II, Fig. 1.) Represented by an elytron only, of a moderately short and broad type, the disk arched and marked with nine rather deep striæ at the bottoms of which are series of strong rounded punctures, becoming smaller at apex and sides. The interspaces between the striæ are somewhat convex but not sharp, excepting the outer two which are subcarinate. There is no sign of scaly vestiture. The width between the rows varies somewhat, but in general the interspaces are about as broad as the punctures or a little less. In the rows themselves, the punctures are ordinarily separated by less than their own diameters. Length, 5.40 mm. Width, 2.80 mm.

Station number 14. Collected by S. A. Rohwer. The type and only known specimen, in obverse and reverse, is in the Museum of the University of Colorado.

Among the fossil forms known from Florissant, this compares only with *O. absconsus* Scudd., a larger form of narrower build and with heavily scaled elytra.

O. cinereus *Scudd.* One specimen from Station number 14, collected by S. A. Rohwer.

Ophryastes *Schönh.*

O. championi n. sp. (Plate I, Fig. 3.) Specimen preserved partly in profile, the head slightly twisted so as to show part of the top. Beak thick, very slightly arcuate, and, measured from its apex to the front of the eye, a little shorter than the prothorax, two strong straight sulci on the rostral disk extending from a point about opposite the anterior end of the antennal scrobe to the base; from the position of the beak it is quite possible that a third sulcus was present, as in *O. latirostris*. Scrobe deep, oblique, directed against or in front of the lower margin of the eye. Head finely sculptured with small punctures. Eye broken on the lower edge, but probably pointed beneath. Antennæ wanting. Prothorax, as preserved, about one third higher than long, dorsum arched, more strongly posteriorly, ocular lobe pronounced but not excessively strong, discal and lateral sculpture (shown only in part in the figure) strong and irregular, more or less rugose. Elytra somewhat broken, outline only moderately arched, sculpture composed of rather regular rows of rounded deep punctures, those of the disk stronger and larger than the lateral ones. None of the rows are in complete preservation, so it is not possible to determine the exact characters of their apices. Apparently from overlapping of the elytra, the extreme discal striæ are obliterated or mixed so that the figure is made to show only those rows which are traced with certainty. Abdomen somewhat distorted, but the third and fourth ventral segments, as seen from the side, are much shorter than the first and second, while the fifth is longer than the two preceding united. The abdominal sculpture is a fine subrugose punctuation. Legs wanting, except one of the first pair, which shows the coxa to have been small and globular, the tibia rather long and slender. The femur is foreshortened, being set in the stone at an angle. Length, from apex, of elytra to front margin of prothorax, 9.50 mm.

Station number 14. Collected by Mrs. W. P. Cockerell. The type is in the Museum of the University of Colorado.

The only specimen is a reverse, the sulci above described being represented by ridges and the punctures by tubercles. It is difficult to get an accurate idea of the size and spacing of the punctures under these conditions, but they appear as represented in the figure. The punctures were probably not set in impressed striæ. The interspaces were finely closely granulate or else clothed with thick rounded scales, since impressions indicate one or the other of these structures. The insect seems to have had an appearance similar to the recent *O. tuberosus*. Judging from the descriptions and figures, this cannot be either of the two species of *Ophryastes* described by Scudder and it bears no special resemblance to any of his other Florissant Rhynchophora.

I take pleasure in naming this fine species for Mr. G. C. Champion of London, England.

Otiorhynchites *Fritsch* (emend. *Scudd.*).

O. florissantensis *Wickh.* (Plate I, Fig. 1.) A figure of this species is given, which will show the form of the elytron and the arrangement of the punctures over a portion of the surface. The part drawn is somewhat more irregularly sculptured than most of the remainder.

Cyphus *Germ.*

C. subterraneus *Wickh.* (Plate II, Fig. 4.) The figure is intended to illustrate the outline and the courses of the elytral striæ as far as they are traceable. It is drawn from the type.

Geralophus *Scudd.*

G. antiquarius *Scudd.* Occurs at Stations number 13, 13B and 14. All of the nine specimens before me were collected by S. A. Rohwer and Mrs. W. P. Cockerell.

G. occultus *Scudd.* Two pairs taken by S. A. Rohwer and two single specimens collected by Mrs. Cockerell, all from Station number 14.

G. scudderi *Wickh.* (Plate IV, Fig. 8.) This is mentioned merely to call attention to the figure.

G. saxuosus *Scudd.* One paired specimen from Station number 14, Mrs. Cockerell.

G. fossicius *Scudd.* Station number 14, one pair, collected by Mrs. Cockerell: Station number 17, a single specimen taken by S. A. Rohwer: Station 21, a single specimen from Mrs. Cockerell: and another example without special locality.

G. repositus *Scudd.* Two single specimens from Station number 14, collected by Prof. Cockerell, and another example, referred here with some doubt, from Station number 13, collected by S. A. Rohwer.

G. lassatus *Scudd.* This is the most abundant species. Specimens were taken by all of the members of the expedition and are marked with the Station numbers 13, 14, and 17.

G. pumiceus *Scudd.* A single specimen from Station number 14, S. A. Rohwer, is placed here with some doubt.

G. retritus *Scudd.* One specimen, Station number 17, collector not specified.

Coniatus *Germ.*

C. differens n. sp. (Plate III, Figs. 3 and 4). Form moderately stout. Head small, strongly and closely but finely punctate on the vertex, eye circular, beak about as long as the prothorax, regularly arcuate, surface finely roughened, scrobe shallow and somewhat obscured. Prothorax short, a little tapering, but the lower edge is crushed so that the original form is not entirely retained, disk and sides to near the margin beset with deep closely placed circular punctures of small size but much coarser than those of the head. Elytra broken at tip but moderately arched, surface minutely roughened and marked with moderately deep regular striæ, the striæ with series of strong longitudinal punctures, interspaces a little convex, without visible hairs. Body beneath punctured similarly to the pronotum but less closely and deeply, especially upon the abdominal segments. Legs fairly stout. Length, from front of head to tip of abdomen, 4.00 mm.

Station number 14. Collected by Mrs. W. P. Cockerell. The type and only known specimen is in the Museum of the University of Colorado.

Resembles *C. eviscerutus* Scudd., in form, but is larger, the head is strongly punctate but not striate and the beak is a little shorter.

Apion *Hbst.*

A. confectum *Scudd.* Station number 13, S. A. Rohwer: Station number 17, S. A. Rohwer and Mrs. W. P. Cockerell. In all, the species is represented by four examples, one of which is paired.

A. exanimale *Scudd.* A poor paired specimen from Station number 14, collected by Mrs. Cockerell. I am not sure of the specific reference.

A. refrenatum *Scudd.* Two pairs and one single specimen from Station number 13: a single specimen from Station number 14. All are collected by S. A. Rohwer.

Cleonus *Schönh.*

C. estriatus n. sp. (Plate II, Fig. 3.) Form moderately stout for this genus, subparallel. Head finely but closely punctate, the punctures circular and extending well out on to the rostrum, becoming finer towards the apex and finally evanescent close to the tip where they seem to be replaced by a mere roughening. Beak, viewed from above, broad, tapering rather gradually into the head, sides subparallel from shortly in front of the base to the truncate apex, median line probably carinate, fairly distinct, flanked on each side by a finer line. Eyes not defined. Prothorax about two fifths broader than long, base wider than apex, no evident apical constriction, gradually narrowing from the base but more rapidly and arcuately so near the tip. The sculpture consists of fine circular closely crowded punctures, evenly distributed and only barely perceptibly larger than those of the head. Scutellum broad, triangular, much wider than long, punctured about like the prothorax but a little more finely. Elytra subparallel at sides but tapering somewhat near the apex, sculpture of fine but well marked widely separated and somewhat irregularly distributed punctures, each of which carries a short slender hair. There is no sign of striæ. Legs wanting. Abdominal segments, in part, showing through the elytra, two of these, probably the third and fourth, being short and subequal, sutures slightly arcuate. Length, to tip of rostrum, 8.75 mm.; of beak, about 1.20 mm.; of elytra, 4.90 mm. Width of both elytra, 3.00 mm.

Station 14. Collected by Mrs. W. P. Cockerell. The type and only known specimen is in the American Museum of Natural History.

The above described species cannot be referred to any of Dr. Scudder's Cleonini, since it differs radically from all of them in sculpture. In this particular, it comes nearest to *Eocleonus subjectus*, but in that beetle the punctures of the head and prothorax are confluent and form a more or less vermiculate structure. The lack of elytral striæ in *C. estriatus* is the most striking character in comparison with all of the known Florissant fossils of the group. Regarding the generic assignment, it is possible that *C. estriatus* will eventually require a new genus for its reception. It differs from all the American Cleonini known to me in the non-striate elytra, lack of basal prothoracic lobe and in having a large distinct scutellum. Although I have examined a considerable number of exotic species of the tribe, as well as natives, I find nothing that agrees with it in all of the above characters, though the Algerian *C. ophthalmicus* has a similarly non-lobate thoracic base. The meso-scutellum in *Cleonus* is really of good size, as may be seen by dissection, but it is mostly hidden by the overlap of the prothorax. The punctuation of the scutellum on my specimen indicates, I think, that it was exposed in life and strongly visible.

C. rohweri *Wickh.* (Plate I, Fig. 4.) The figure will show the form, the courses of the elytral striæ and the proportions of the different parts of the body. The punctuation is not indicated on the drawing, and reference must be had to the original description.

C. primoris *Scudd.* One specimen from Station number 14, collected by Mrs. Cockerell.

C. foersteri *Scudd.* Six specimens, all from Station number 14, collected by S. A. and Geo. N. Rohwer.

C. degeneratus *Scudd.* One paired specimen from Station 14, collected by Prof. Cockerell.

Dorytomus *Steph.*

D. vulcanicus n. sp. (Plate IV, Fig. 1.) Form elongate and as seen in profile about parallel. Head much higher than long, finely and extremely closely but not confluently punctured on the upper half, the punctures circular and rather deep. The lower half is marked with about eleven fine transverse striæ which very nearly follow the curve of the thoracic margin. Eye elliptical, transverse, close to the base of the beak which is slightly arcuate, of nearly uniform thickness throughout, distinctly but rather finely striate and minutely granulate, the scrobe lateral, directed below the middle of the eye. Prothorax about one and one-half times as high as long, no post-ocular lobes, surface punctured about like the head. Elytra about three times as long as the prothorax, sculpture indistinct but consisting of rows of well separated moderately fine punctures, the punctures circular or occasionally elliptical in form. Metasternum punctured similarly to the prothorax, abdominal sculpture perceptibly finer. Legs moderate, front thigh strongly toothed. Length, exclusive of rostrum, 4.75 mm.; of beak, about 1.75 mm.

Station number 17. Collected by Mrs. W. P. Cockerell. The type and only known specimen is in the Museum of the University of Colorado.

In general, this insect compares quite closely with the recent *D. laticollis* from New Hampshire. It does not agree with the figures nor descriptions of either of the two fossil species described from the Florissant shales by Dr. Scudder. Compared with *D. williamsi* Scudd., the present form has relatively a much shorter beak and longer elytra, while it differs from *D. coercitus* Scudd., in having the beak stouter, shorter and distinctly striate, as well as in the dentation of the front femur.

Magdalis *Germ.*

M. striaticeps *Wickh.* (Plate II, Fig. 2.) The drawing will show the few characters of the species that can be made out. Unfortunately the specimen is in poor preservation.

Anthonomus *Germ.*

A. rohweri n. sp. (Plate IV, Figs. 11 and 12.) Form, in profile, subparallel, elytra scarcely arched except behind the middle. Head moderate, strongly punctured in an arcuate area just back of the eye and distinctly transversely striate on the cheek. Beak curved, the bend rather sudden and a little antemedian, surface punctate and striate. Eye elliptical. Prothorax a little shorter than the beak, dorsum very little arched, surface strongly coarsely (for such a small insect) and subconfluently punctate on the disk, the punctures generally circular in form; at the sides below, they disappear and are replaced by a slight roughening only. The spaces between the punctures are finely alutaceous. Elytron marked with strong rows of punctures in striæ, the striæ themselves fairly deep, the interspaces convex, transversely rugulose and finely irregularly punctulate. The strial punctures are elongate and distinctly narrower than the interspaces, but longitudinally they approach one another very closely. Under surface of meso and metathorax and the abdominal segments with the punctures a little smaller, less strongly impressed and more distantly placed than on the prothoracic disk, the intervening spaces finely transversely rugulose. Hind femur with a rather strong tooth near the apex, the tibia rather slender and bent at the base. Length, exclusive of rostrum, 2.25 mm.

Station number 13. Collected by S. A. Rohwer. The type is in the Museum of the University of Colorado.

This insect is represented by a single specimen, and compares with *A. defossus* Scudd., but has a less strongly arched back, there is no sign of hairs on the prothorax, in spite of the fine preservation, and the elytral striæ are strongly punctured, while Scudder simply describes them as dull rugulose in his species. My figures will show the courses of the striæ as far as they can be made out, and the arrangement of both strial and interstitial punctures.

Sibynes *Germ.*

S. whitneyi *Scudd.* Two specimens, neither of them very well preserved, are referred here. Both are from Station number 14, one collected by Mrs. Cockerell, the source of the other not specified.

Conotrachelus *Schönh.*

C. florissantensis n. sp. (Plate III, Fig. 1.) Form stout, moderately arched. Head finely granulate or punctate on the frontal region, vertex becoming transversely rugose. Eye apparently rounded, partly concealed by the post-ocular lobe. Beak rather long, equal, regularly and slightly arcuate, surface roughened and strongly laterally striate or carinate. Prothorax about two thirds as long as high, with well marked but not excessively prominent post-ocular lobe, surface moderately coarsely and deeply punctate, the punctures usually about circular and close set, becoming confluent in rows upon the disk and upper parts of the sides, so as to form wavy rugæ. Elytra largely obscured by the impression of the other body parts, but the stone shows them to have been rather deeply striate, the striæ marked with regular deep punctures separated by about their own long diameters, the punctures being somewhat elongate or elliptical in outline. Sternal pieces of meso and metathorax strongly and moderately coarsely cribrately punctured, abdomen much more finely punctate. The first and second abdominal segments are about equal, the third and fourth much shorter, together equal to either of the foregoing, the fifth about as long as the first. Legs stout, finely roughened, tibiæ curved, the front ones, at least, longitudinally striate. Front femora strongly unidentate, hind ones apparently mutic. Length, exclusive of rostrum, 6.20 mm.; of beak, about 2.20 mm.

Station number 14. Collected by Mrs. W. P. Cockerell. The type and only specimen is in the Museum of the University of Colorado.

By all the visible characters, should undoubtedly go into the genus *Conotrachelus*. In outline, it resembles the recent *C. nenuphar* very strongly, but the sculpture of the beak, head and thorax is more like that of *C. cribricollis*, though less coarse. The proportions of the abdominal segments, the connation of the first and second across the median area and the bent ends of the last three sutures are strikingly similar to the abdominal structures of our modern Conotracheli. The only one of Scudder's weevils which seems to approach closely in any way is his *Rhysosternum æternabile*. That insect is much more slender, has a relatively longer beak, different elytral sculpture and, according to Scudder's figure, the abdominal segments are not of the same proportions. In my figures, the lines representing the elytral striæ are to be taken as indicating the courses but not the width. The punctuation is shown only in part, since it is obscured over much of the elytral area.

Cryptorhynchus *Illiger.*

C. coloradensis n. sp. (Plate III, Figs. 6, 7 and 8.) Form elongate, especially as to the elytra. Head almost entirely concealed by the prothorax, finely closely punctate near the eye which is quite small and subelliptical. Beak nearly straight, rather broad in profile, the base damaged, but, so far as can be seen, tapering to the tip from a point at about apical two thirds, moderately strongly striate and finely roughened. Antenna showing five funicular joints, subequal in length, approximately as broad as long except the last one, which is a little wider, club elliptical, pointed, three jointed, as long as the four preceding joints of the funicle. Prothorax short, form apparently badly distorted, but seemingly with strong post-ocular lobes. Surface deeply, finely and extremely closely but not confluently punctured, each puncture with fine striæ at bottom. Elytra also somewhat distorted but long, finely punctato-striate, the striæ shallow, the punctures strongly longitudinal, scarcely if at all wider than the striæ and moderately well impressed, interstitial spaces nearly flat, broad (three or four times as wide as the striæ), with scattered fine punctures and marked with a minute feathery fan-shaped alutaceous sculpture due probably to the impressions of striated scales. Each of these little alutaceous patches is practically equivalent in size to one of the strial punctures, or a little less, and in some cases they encroach on the striæ. Underside of the body finely closely punctured, the punctures with fine lines similar to those on the presumed scale impressions of the elytra, the abdominal sculpture a little finer than the thoracic. Legs wanting except a detached portion of what I take to be a fore tibia, of fairly stout build, and two joints of a hind tarsus. Length, exclusive of the rostrum, 5.90 mm.; of the beak, about 1.85 mm.

Station number 14. Collected by Geo. N. Rohwer. The type is in the Museum of the University of Colorado.

I place this strange weevil, known only from the single specimen, in the genus *Cryptorhynchus* in its broad sense. It bears a general resemblance to some of the large tropical Cryptorhynchids which have a similarly, though less exaggerated, short thorax. The generic reference is also borne out by the presence of post-ocular lobes, the short third and fourth abdominal segments, the beak structure and the antennæ. Nothing approaching it is to be found in Dr. Scudder's memoir. The figures will give an idea of the outline of the body and the courses of the striæ, except at the apex where they are obscure. Details of the strial punctuation and of the presumed scale marks are also shown.

C. fallii n. sp. (Plate III, Fig. 9.) Form stout. Head with fine close punctuation becoming somewhat rugose laterally. Eye elliptical, close to the base of the beak. Rostrum nearly straight, apparently with a rather strong constriction at base, median part wider than the basal, surface finely closely punctate, scrobe about straight, moderately deep and terminating just before the eye. Prothorax a little more than half as long as high, dorsal outline not distinguishable on account of the condition of the stone, front margin with distinct though not very strong ocular lobe, surface closely though not confluently punctured, the puncta of moderate size, becoming smaller near the lower margin. Elytron a little more than twice the length of the prothorax, and about one and a half times as long as wide, deeply striate, the striæ with rather small, distinct, well separated, subcircular punctures, the interstitial spaces convex and strongly alternating in height. There is evidence of punctuation on the interspaces as well as in the striæ but the exact nature of this interstitial sculpture is not easily made out. The appearance is that the flatter interspaces have a double row of fine circular punctures, the more convex ones a single median row of rather shallow transverse depressions giving a scabrous effect. Abdomen and sternal pieces of the meso and metathorax punctured similarly to the disk of the prothorax but a little less strongly. Legs more finely punctate. As far as can be seen, the thighs are not toothed. Length, exclusive of rostrum, 4.90 mm.; of beak, about 1.65 mm.

Station number 14. Collected by Mrs. W. P. Cockerell. The type and only specimen (in obverse and reverse) is in the Museum of the University of Colorado.

In a general way this beetle resembles the figure of *Geralophus discessus* Scudd., but that genus is said to be without post-ocular lobes. There are several points of disagreement in the specific characters as well. I have felt fairly safe in assigning the present species to *Cryptorhynchus* in the broad sense used by Illiger, but have not cared to attribute it to any of the more restricted groups into which that genus has been divided. The form, sculpture, alternation of elytral intervals, beak structure and ocular lobes are all Cryptorhynchine. In reference to the figure, the lines representing the striæ are intended merely to indicate their course, and relative positions.

These details and those of the punctuation (which is shown only on those parts of the elytra where best preserved) were made with the camera lucida.

The species is named for Mr. H. C. Fall of Pasadena, California.

C. kerri *Scudd.* Seems to have been fairly abundant. Two paired specimens come from Station number 13, S. A. Rohwer: two others are from Station number 14, Geo. N. Rohwer: and another, single, is from Station number 17, Mrs. W. P. Cockerell.

Baris *Germ.*

B. hoveyi n. sp. (Plate IV, Figs. 5, 6 and 7.) Form moderately elongate, recalling some of the recent species of *Limnobaris*. Head small, finely punctate, beak slender, rather long, slightly and regularly curved, not tapering much. Eye rather large, transverse. Antenna with the first funicular joint longer than the third and fourth united, club somewhat elliptical. Prothorax, in profile, a little higher than long, tapering arcuately and regularly to apex, back and breast pursuing similar but reversed curves, punctuation coarse and close, deep, but scarcely at all confluent, the punctures circular, stronger on the sides near the breast. Elytra moderately long, back only moderately arched, striate, the striæ with extremely deep coarse round punctures, those of each stria separated by less than half their own diameters, but a little more distant from those in the adjoining rows. Towards the sides and apex, the punctuation is finer. Interstitial spaces somewhat convex, each with a row of smaller punctures as shown in the detail figure, these small punctures showing more plainly on each alternate interspace. Underside of meso and metathorax punctured similarly to the prothorax, abdominal sculpture indistinct, probably on account of the state of preservation. Legs short, stout, and rather evidently punctured. Length, exclusive of rostrum, 2.75 mm.

Station number 14. Collected by S. A. Rohwer. The type is in the American Museum of Natural History.

Represented by a single specimen in good preservation. Among Scudder's species, this compares only with *B. matura* which differs, if we may rely upon the figures and description, in having the strial punctures somewhat longitudinal and closer together, while the interstitial spaces are impunctate. The generic reference is to be understood in the broad sense.

Named for Dr. E. O. Hovey, of the American Museum of Natural History.

B. schucherti n. sp. (Plate IV, Figs. 3 and 4.) Preserved in profile. Form, in this view, subparallel, moderately stout. Head very finely sculptured, a slight punctulation being visible under considerable magnification. Eye not definable, beak stout, slightly curved. Prothorax long, closely and rather coarsely but not deeply punctured on the discal area, more finely near the sides and front. Elytra a little less than one and one half times as long as the prothorax, regularly but not very deeply striate, striæ punctured, punctures circular, moderately deep, flat bottomed, a little more widely spaced in the rows nearest the outer margin, so that while the punctures of a discal row are separated by about their own diameters, those of the rows near the margin are sometimes distant half as much again. The rows are separated by twice the diameters of the punctures. The interstitial spaces are about flat and apparently finely punctulate or roughened. Underside rather faintly and moderately closely punctate, a little more strongly on the thoracic than on the abdominal segments. Legs wanting. Length, excluding rostrum, 4.20 mm.

Station number 17. Collected by Mrs. W. P. Cockerell. The type, showing obverse and reverse, is in the Museum of the University of Colorado.

This beetle is much larger than any of the species of *Baris* described from Florissant by Dr. Scudder. It differs from all of them in so many details that there is not the slightest danger of confusion. The generic assignment must be understood as referring to *Baris* in the wide sense, since the antennal characters cannot be studied. The peculiar jointed appearance of the pronotum may be due to cracking or to some shifting of the opposite and underlying thoracic walls. The abdomen appears to have the tip broken off, the segments beyond the second are not definable. The representation of the elytral striæ in the outline figure is intended to show their courses, the detail of the punctuation being shown on a higher scale in another drawing.

I give this species the name of Prof. Chas. Schuchert of Yale University.

B. matura *Scudd.* (Plate IV, Fig. 2.) Form rather stout, body decidedly less than twice as long as high, dorsal line only moderately and evenly arcuate. Head of moderate size, finely closely punctate, the punctures circular, beak slightly arcuate, striate and finely roughened, not strongly tapering, a little longer than the prothorax. Eye close to the base of the beak, slightly elliptical and oblique. Prothorax twice as high as long, strongly, not very finely, closely punctured, the punctures circular and regular, much larger than those of the head.

Station number 14. Collected by S. A. Rohwer.

A specimen, with reverse, agrees well with the description and detail figure of this species as given by Dr. Scudder. However, since my example is preserved in profile while his was in dorsal view, I thought it well to give the above notes and a figure to supplement his. This will allow the species to be compared more exactly with others known from Florissant, all of which seem to have been described by Dr. Scudder from profiles.

Balaninus *Germ.*

B. extinctus n. sp. (Plate IV, Figs. 13, 14 and 15.) Form moderately robust, obtuse at both ends. Head large, moderately coarsely and fairly closely punctured above, finely rugose on the lower parts of the cheek. Eye elliptical, transversely oblique. Beak, measured on the chord of the lower arc, slightly more than half the combined length of the thorax and elytra, moderately and nearly regularly arcuate, surface finely roughened, scrobe deep. Prothorax short, distinctly more than twice as high as long, disk and upper part of the side with moderate sized circular punctures, regularly disposed and separated by approximately their own diameters, becoming gradually finer and more widely separated ventro-laterally. Elytra about three and one half times as long as the prothorax, rather finely punctate in striæ, striæ seemingly finely impressed, the punctures circular and widely spaced, as shown in the detail figure. Underside punctured similarly to the prothoracic disk, but more finely on the abdominal segments. Legs with moderately strongly clavate thighs, not visibly toothed, tibiæ slender. Length, exclusive of rostrum, 2.40 mm.

Station number 17. Collected by Mrs. W. P. Cockerell. The type is in the Museum of the University of Colorado.

The single specimen at hand indicates that this insect was not closely related to those described by Scudder, being much smaller than any of them. It may approach the European species of *Balanobius* but seems to have shorter legs.

B. restrictus *Scudd.* The collection contains three specimens of a fine large *Balaninus* from Station number 14 and 20, represented by obverses and reverses, as well as another example from Station number 14 in reverse only. One of these is preserved on the flat, the remainder are side views. All agree in having a relatively short beak, about 3.50 mm. long, the outline of which varies somewhat in curvature but most closely approximates the figure of *B. restrictus* Scudd., which species is also closely imitated in form and elytral structure. In length, they vary from 7.00 to 9.50 mm. I do not find well marked characters for separation and have therefore assumed that they represent but one species, which I have assigned as above.

B. minusculoides *Wickh.* (Plate III, Fig. 2.) A figure of this species is given to supplement the description. No additional specimens have come to hand.

B. minusculus *Scudd.* One specimen from Station number 14, S. A. Rohwer: one from Station number 17, Geo. N. Rohwer: and another from the same place, Mrs. W. P. Cockerell.

Scyphophorus *Schönh.*

S. fossionis *Scudd.* Station number 14, S. A. Rohwer, a paired specimen. This shows, in the reverse, that the ridges corresponding to the elytral striæ are slightly interrupted at short and regular intervals, indicating that the striæ were faintly punctate. The prothorax also shows a fine punctuation.

Cratoparis *Schönh.*

C. adumbratus *Wickh.* (Plate I, Fig. 2.) The figure will show the outline and the courses of the elytral lines of punctures, but these lines are very nearly obliterated over a great part of the surface in the unique type. The nature of the punctuation is shown over a small area only.

EXPLANATION OF PLATES.

Plate I.

Fig. 1. Otiorhynchites florissantensis *Wickh.*
“ 2. Cratoparis adumbratus *Wickh.*
“ 3. Ophryastes championi n. sp.
“ 4. Cleonus rohweri *Wickh.*

Plate II.

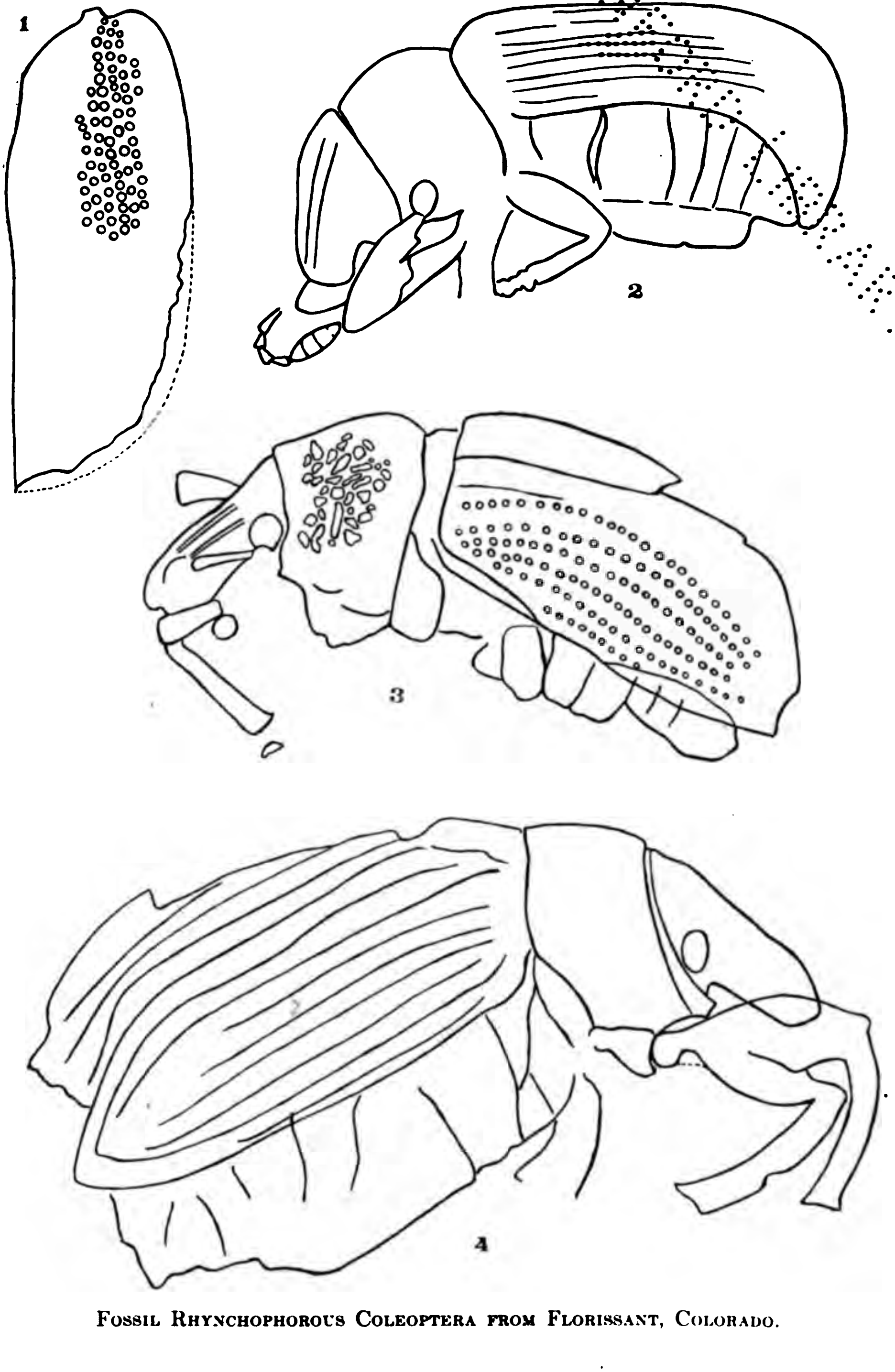
Fig. 1. Ophryastites miocenus n. sp.
“ 2. Magdalis striaticeps *Wickh.*
“ 3. Cleonus estriatus n. sp.
“ 4. Cyphus subterraneus *Wickh.*

Plate III.

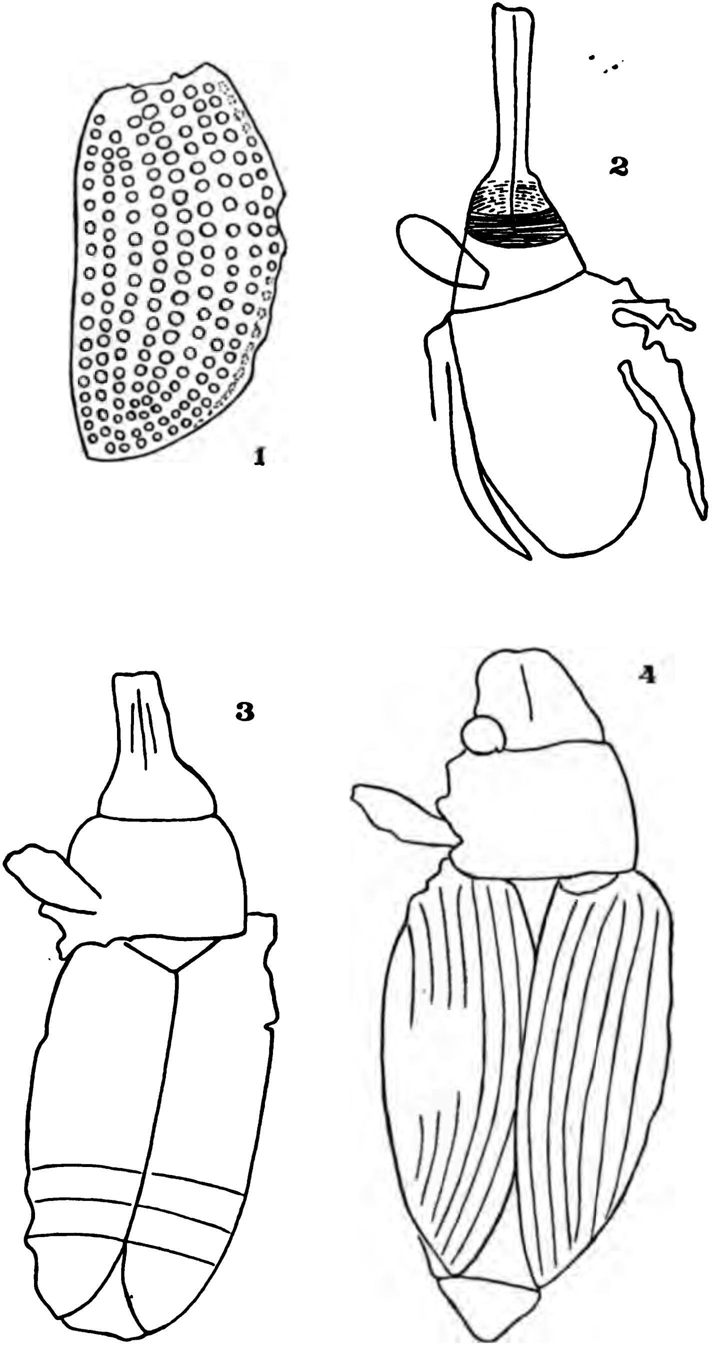
Fig. 1. Conotrachelus florissantensis n. sp.
“ 2. Balaninus minusculoides *Wickh.*
“ 3. Coniatus differens n. sp.
“ 4. “ “ detail of elytral punctuation.
“ 5. Toxorhynchus grandis *Wickh.*
“ 6. Cryptorhynchus coloradensis n. sp.
“ 7. “ “ detail of antenna.
“ 8. “ “ “ of elytral punctuation and scales.
“ 9. “ fallii n. sp.

Plate IV.

Fig. 1. Dorytomus vulcanicus n. sp.
“ 2. Baris matura *Scudd.*
“ 3. “ schucherti n sp.
“ 4. “ “ detail of elytral punctuation.
“ 5. “ hoveyi n. sp.
“ 6. “ “ detail of antenna.
“ 7. “ “ “ of elytral punctuation.
“ 8. Geralophus scudderi *Wickh.*
“ 9. Eugnamptidea tertiaria n. gen. et n. sp.
“ 10. “ “ detail of antenna.
“ 11. Anthonomus rohweri n. sp.
“ 12. “ “ detail of elytral punctuation.
“ 13. Balaninus extinctus n. sp.
“ 14. “ “ detail of antenna.
“ 15. “ “ “ of elytral punctuation



Fossil Rhynchophorous Coleoptera from Florissant, Colorado.



FOSSIL RHYNCHOPHOROUS COLEOPTERA FROM FLORISSANT, COLORADO.

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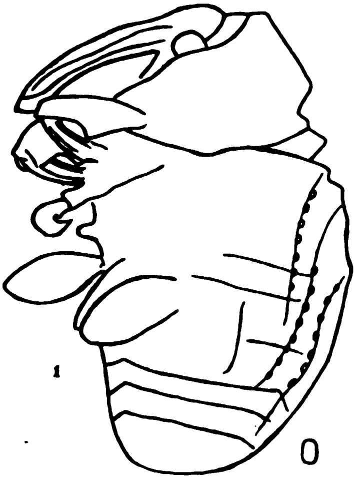
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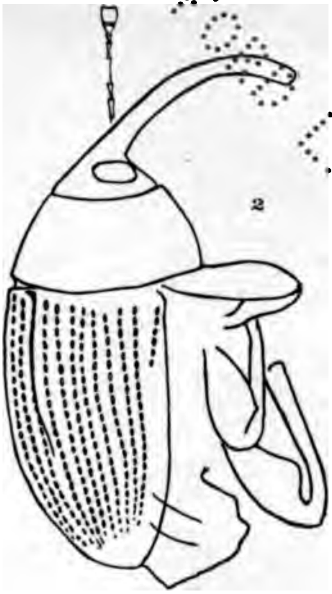
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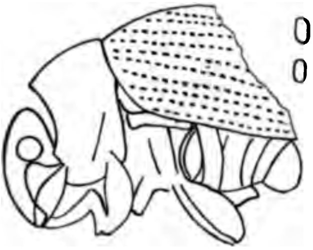
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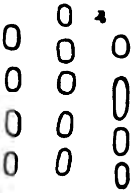
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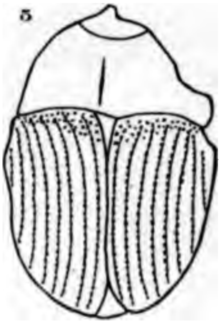
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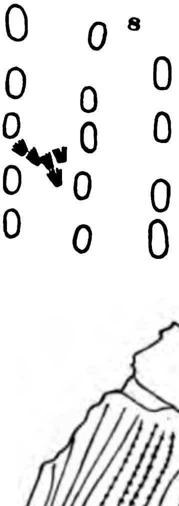
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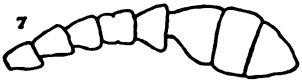
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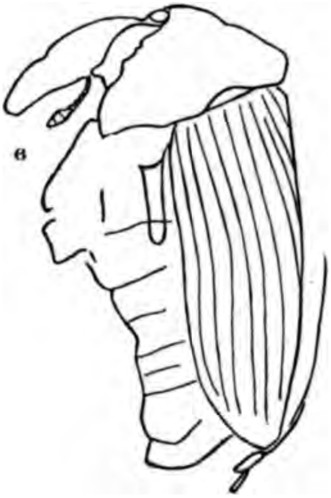
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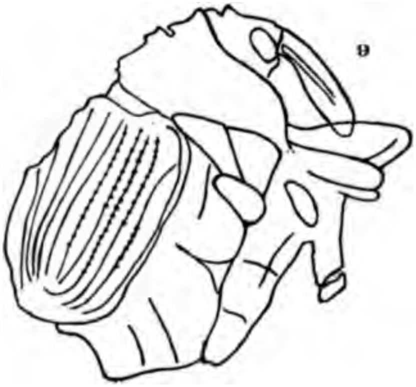
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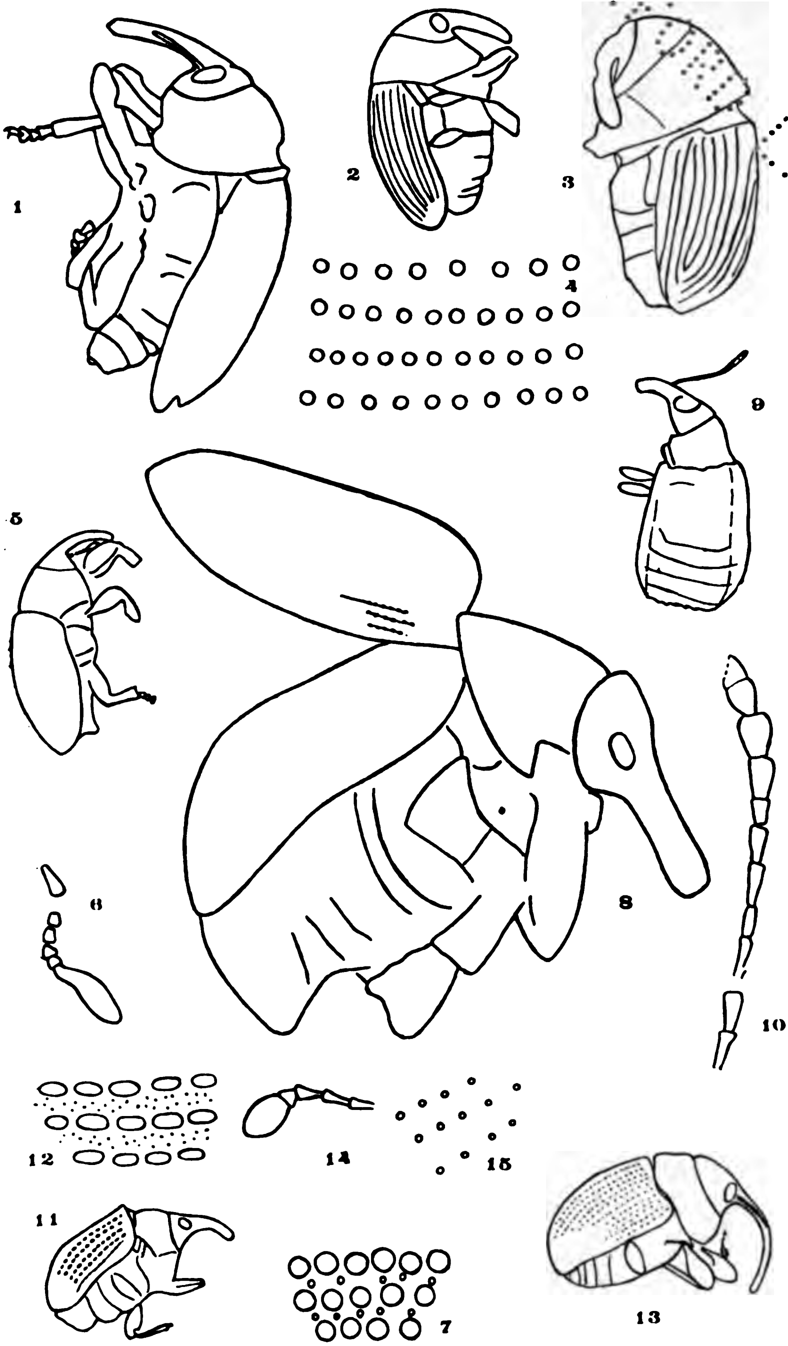
Fossil Rhynchophorous Coleoptera from Florissant, Colorado.



Fossil Rhynchophorous Coleoptera from Florissant, Colorado.

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Article V.—NOTES ON THE TERTIARY DEPOSITS OF THE BIG-HORN BASIN.

By W. J. Sinclair, Princeton University, and Walter Granger, American Museum of Natural History.

Plates V and VI.

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  A Vertebrate Faunal Horizon near the Top of the Fort Union (?) . 58
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INTRODUCTION.

In continuing, during the summer of 1911, investigations begun the preceding year on the Tertiary deposits of the Bighorn basin in northwestern Wyoming, a number of new facts have come to light which it is deemed advisable to publish. The presentation of these data may, however, be prefaced to advantage by a brief statement of the stratigraphy, structure and lithology of the basin deposits, and of the special problems relating thereto which we have attempted to solve.

The drainage area of the Bighorn River is, structurally, a region of downwarp, inclosed more or less completely to the east, south and west by mountains of upwarp. The basin so formed is underlain by all the members of the Rocky Mountain section from the Archæan to the Fort Union and has been filled by a conformable series of clay, sand and gravel beds subdivided on palæontological evidence into the Knight formation (Wasatch), the Lysite and Lost Cabin formations (Wind River), all three known from their fossils to be Lower Eocene in age, the Tatman formation, a name which we propose for certain lignitic shales and sandstones overlying the Lost Cabin formation and of doubtful age, and, finally, various gravels capping the Tertiary section which it has not been deemed advisable to name. As announced in an earlier publication,[1] microscopic examination of these sediments undertaken with the object of determining the origin of the materials composing them has shown that they have all been derived from the older rocks of the mountains and have been transported into the intermontane basin by streams. They represent, therefore, the waste of the mountains accumulated since the deformation of the Fort Union, on the uptilted edges of which the Knight formation rests unconformably. The Eocene clays are brilliantly colored and exhibit a more or less regular alternation of red and pale blue (yellow-weathering) bands of variable thickness and, frequently, of great horizontal extent. The colors seem to depend on the amount of iron present in the clays, the red variety carrying, in the two analyses which have been made, one and one-half percent more iron than the blue. We have suggested that the accumulation and oxidation to hematite of the excess of iron salts in the red clays may have occurred during dry climatic cycles and that the blue clays were deposited under moister conditions less favorable to the concentration and oxidation of the iron. That the deformative stresses which flexed the older rocks into their basin structure continued to act after the deposition of the Tertiary sediments filling the basin is shown by the presence of marginal anticlines and synclines and the general centripetal dip of the entire Lower Eocene series. The field work of the season just past shows that flexing of the basin deposits occurred after the deposition of the Tatman formation, which is post-Wind River in age.

The following report is merely a supplement to the already published, fuller presentation of the subject.

NEW FACTS REGARDING THE TERTIARY STRATIGRAPHY OF THE BASIN.

A Vertebrate Faunal Horizon near the Top of the Fort Union (?).

McCulloch Peak (Map, Fig. 1) is a residual butte with three summits, approximately 6200 feet high, and composed entirely of Eocene clays and sandstones. Structurally, it is synclinal, the beds dipping, with minor irregularities, toward the central peaks. This syncline probably owes its existence to the same causes which produced the Elk Creek anticline discovered last year, namely mountain uplift accompanied by compression and flexing of the marginal portion of the intermontane trough. Banded clays are found to the very summit. The lowest beds rising above the broad bench on the south side of the Shoshone opposite Ralston and Powell contain *Systemodon* and are, therefore, referable to the Knight formation. At higher levels the Wind River may occur, but fossils are scarce and the region is so rough and inaccessible that we have not yet been able to verify this assumption. It is known, however, that the lignitic beds which we propose to call the Tatman formation overlying the Wind River on Tatman Mountain, are not present on McCulloch Peak. Due east from the lower end of the Irma ditch, on the southwest slopes of the peak, the red-banded Knight beds with *Eohippus* and other characteristic fossils rest on a series of bluish shales or clays, with one or two pink bands, overlain by a heavy yellow-brown sandstone (Plate V). These beds dip at a steeper angle (21°–23°) than the banded clays above, although in the same general northwesterly direction, and are slightly discordant with them in strike. Apparently the two series are unconformable. Fisher's map[1] includes the bluish beds below the banded series in his "Laramie and associated" formations, now known to be in large part Fort Union. At a locality on the southwest slopes of McCulloch Peak shown in the accompanying photograph (Plate V), about a mile due east of the point where the Wasatch-Fort Union contact line crosses the Shoshone River (see map), 245 feet stratigraphically below the contact with the red-banded beds, the following vertebrates, determined by Dr. W. D. Matthew, were found in the so-called "Laramie and associated," probably the top of the Fort Union:

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[1] Eocene and Oligocene of the Wind River and Bighorn Basins. Bulletin American Museum of Natural History, Vol. XXX, pp. 83–117, 1911.

Phenacodus sp., cf. *primævus*, one specimen.
Phenacodont, small form, two specimens.
Miacid, cf. *Vassacyon*, one specimen.
?Plagiaulacid or Insectivore, one specimen.
?Coryphodon, one specimen.
Creodont, indet.
Bird, indet.

What is believed to be the same faunal horizon occurs on the north side of the Shoshone River in the bluffs opposite Ralston station on the Burlington railroad where the beds seem to dip below the Systemodon horizon on the south side of the river. From these bluffs a partial skeleton of a new species of *Limnocyon* was obtained and also some teeth and limb bones of a medium-sized *Phenacodus*. The *Limnocyon*, although a new species, does not seem to be primitive, as compared with forms already known from the Bridger.

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[1] Geology and Water Resources of the Bighorn Basin, Professional Paper No. 53, U. S. G. S., Plate III.

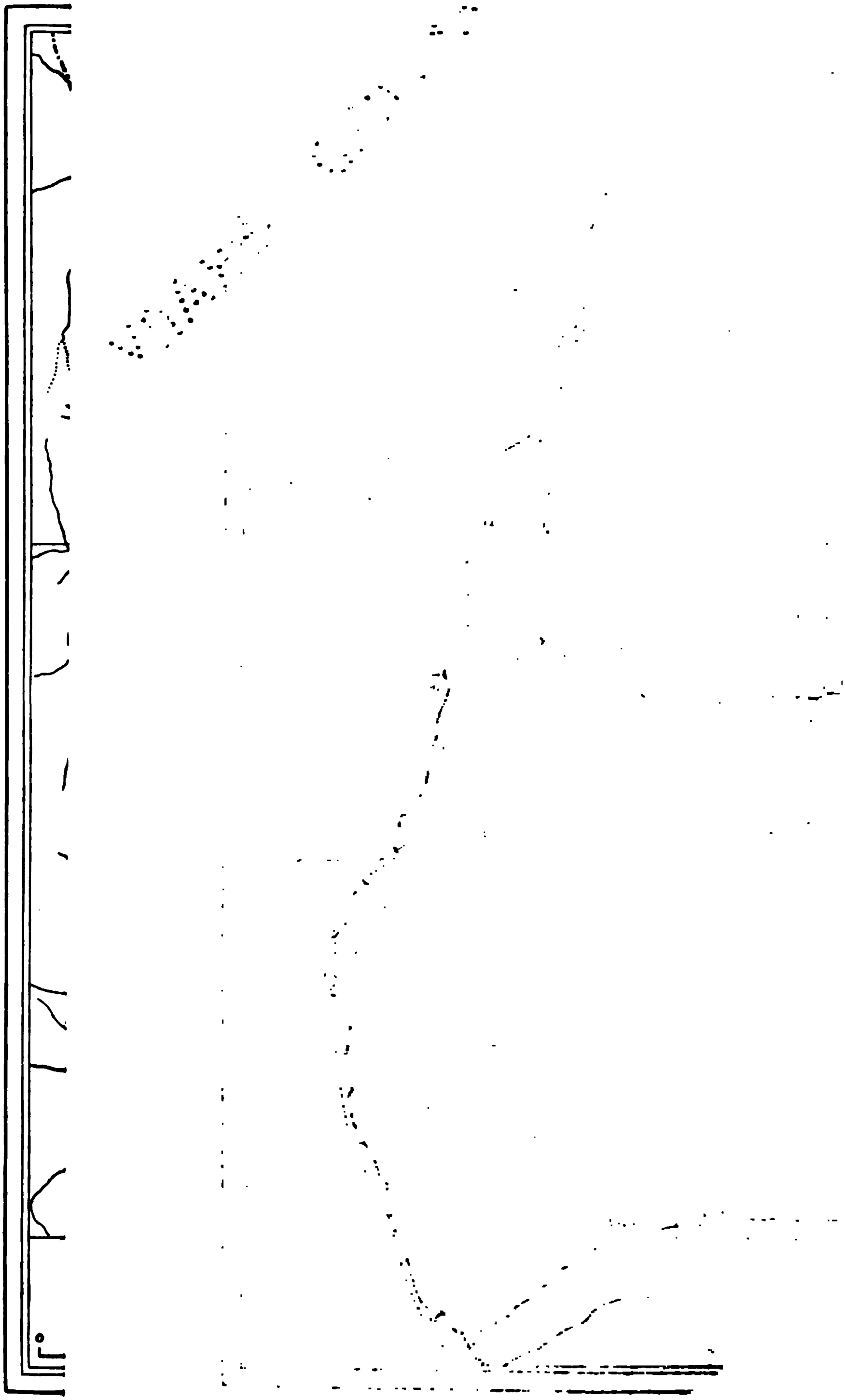
To the northwest of Ralston on Big and Little Sand Coulee (Map, Fig. 1), the following forms, determined by Dr. Matthew, were obtained from beds believed to be the same as those exposed below the Knight formation on the southwest slopes of McCulloch Peak:

Phenacodus sp.
Phenacodus sp., cf. *hemiconus*.
Phenacodus sp., cf. *primævus*.
Didymictis cf. *leptomylus*.
?*Palæonictis* sp.
Esthonyx sp. indesc.
?Small Esthonychid.
Edentate, gen. indesc. (probably Metacheiromyidæ).
Primate or Insectivore.
Bathyopsis sp.

No doubt is entertained regarding the stratigraphic position of the fauna from the southwest slopes of McCulloch Peak. At the other localities, the nearest *Systemodon*-bearing beds are several miles distant on the south side of the Shoshone, where they dip toward the peak. The beds north of Ralston and the exposures on Big and Little Sand Coulee seem to bear the same relation to the *Systemodon* beds on the north side of the McCulloch Peak syncline as do the "Laramie and associated" beds on the south side, namely to underly the Knight, but owing to the discovery in them of *Limnocyon* and *Bathyopsis*, neither of which has heretofore been found in beds as old as the Knight, we feel that further examination of the stratigraphy is desirable. Should the beds in question prove to be older than the Knight, and it be deemed advisable to give them a formation name, they may be referred to as the Ralston beds or Ralston formation.

THE BUFFALO BASIN SECTION.

1. *Distribution of the Knight Formation* (*Wasatch*).— Early workers in the Bighorn basin failed to recognize more than one formation affording vertebrate fossils, the so-called *Coryphodon* zone or Bighorn Wasatch, now known as the Knight formation. The discovery of *Lambdotherium* by the Amherst expedition of 1904 and its localization in the uppermost levels of the red-banded clays beneath the lignitic beds of Tatman Mountain by the American Museum party last year demonstrated the presence of the Wind River. The existence of the Lysite formation beneath the *Lambdotherium*-bearing levels was suspected but not definitely proved. At that time we assumed that the extensive Buffalo Basin exposures south of Tatman Mountain in the drainage area of Dry Cottonwood Creek, better



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known as Fifteen-mile, would prove to be Knight. Much to our surprise we have found sufficient palæontological evidence to show conclusively that they are referable to the Lysite and Lost Cabin formations.

The Knight formation is exposed in the valley of the Gray Bull from a point about five miles west of Fenton (see map, Fig. 1) to the contact with the Fort Union near Basin and on the west side of the Bighorn as far south as the mouth of Fifteen-mile and beyond. On going up Fifteen-mile successively younger formations are found to overlap the Knight, first the Lysite, characterized by the frequent occurrence of *Heptodon* and the entire absence of *Systemodon* or *Lambdotherium*, then the Lost Cabin with both *Lambdotherium* and *Eotitanops* and, finally, on the highest buttes in the basin, the lignitic beds of the Tatman formation. Where the contact between the Knight and the Lysite in Buffalo basin should be drawn on the map is somewhat doubtful as it depends on the presence or absence of certain none-too-abundant fossils in a conformable series of beds and not on stratigraphic or lithologic differences. It certainly lies well to the eastward of the intersection of the main branch of Fifteen-mile with the large dry-wash coming in from the eastern end of Tatman Mountain (see map, Fig. 1). Mapping on an adequate base and careful collecting must be done together before the boundaries of the various Tertiary formations in this area can be delineated.

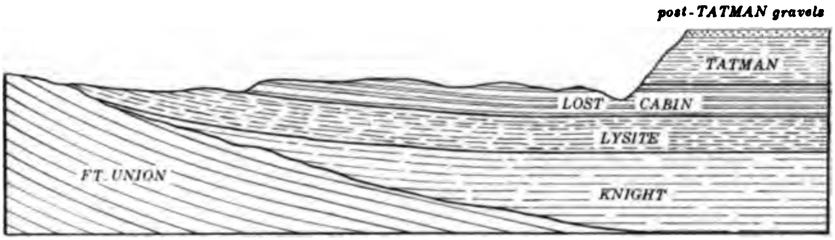

Fig. 2. Diagrammatic section trending in a general northeast-southwest direction from the top of Tatman Mountain toward Meeteetse, showing overlap of the Wind River horizons (Lysite and Lost Cabin) on the Knight formation (Wasatch). Not to scale.

Although the Eocene beds have been uptilted about the southwest margin of the basin, dipping in general, with the exception of minor flexures, toward Tatman Mountain, we have not been able to find any exposures of the Knight formation in this area, the Wind River horizons (Lysite and Lost Cabin) apparently overlapping unconformably on the Fort Union and entirely concealing the Knight as represented in the diagram (Fig. 2). It follows from this that Doctor Loomis's[1] section from near Meeteetse to the top of Tatman Mountain does not show " the character of the Wasatch deposits" but combines four elements, the Fort Union, Lysite, Lost Cabin and Tatman formations.

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[1] Am. Jour. Sci., 4th series, Vol. XXIII, p. 359, May, 1907.

2. *Distribution of the Lysite and Lost Cabin Formations* (Wind River).— On the north side of the Gray Bull-Fifteen-mile divide southwest of Tatman Mountain the deeper cutting of the former stream has incised its valley in the Knight formation while on the divide and to the south and southwest of it younger beds occur. The Lost Cabin formation is exposed on the Gray Bull-Fifteen-Mile divide and on all sides of Tatman Mountain where it may be readily located as the uppermost 325 feet, more or less, of red-banded beds immediately beneath the yellow lignitic shales of the Tatman formation. It extends across Buffalo Basin to the south of Tatman Mountain and may be found in a similar position beneath the Tatman formation both to the north, south and east of Squaw Buttes. The Lost Cabin formation, as at present defined, includes all the Wind River of earlier writers. The existence of the Lysite was not known previous to 1904 when the Amherst expedition made the first collection at the type locality on Lysite Creek and Cottonwood Draw in the Wind River basin.

With the deepening of the valley of Fifteen-mile down stream, toward the east, the Lysite formation is exposed and forms the great field of badlands to the south of Tatman Mountain. Its thickness, scaled from photographs, is probably not in excess of 600 feet and may be less. Like the Lost Cabin formation above it, it can be separated from the older Knight formation only by the fossils it affords. In the Gray Bull valley it may be found in any of the long draws south and southwest of the McGee ranch about five miles below the Y U ranch house where it is represented by brick-red and bluish shales interstratified with sandstone lenses, affording sections indistinguishable from those in the type locality on Lysite Creek and Cottonwood Draw north of Lost Cabin in the Wind River basin. On the north side of Tatman Mountain south of St. Joe post-office it undoubtedly is represented by all or part of the 600 feet of sparingly fossiliferous beds between the *Lambdotherium* zone and the top of the Knight formation with its abundant remains of *Eohippus* (see Plate IX, Fig. 2, Bulletin American Museum, Vol. XXX, 1911). It probably caps the high ridge south of Elk Creek also. At Fenton, the Gray Bull has cut below the base of the Lysite, exposing the Knight.

No Wind River fossils have yet been found on the north side of the Gray Bull, but it is highly probable that they will be found in the upper beds about the summit of McCulloch Peak.

3. *The Tatman Formation.*— We propose the name Tatman formation for a hitherto unnamed series of yellowish shales, yellow-brown and gray

sandstones and lignite beds overlying the red-banded Lost Cabin clays typically developed on Tatman mountain, but occurring also on Squaw Buttes and on the divide between Fifteen-mile and Gooseberry Creeks both to the north, south and west of the buttes. Wherever the contact is exposed, the Tatman formation appears to be conformable with the Lost Cabin beds below. It has not been found north of the Gray Bull River and seems to have been entirely eroded from this portion of the basin Its thickness is estimated by Fisher [1] as about 600 feet.

Microscopic examination of the coarser Tatman sediments suggests that their source was the same as that of the underlying Eocene horizons, but that depositional conditions were different is shown by the scarcity of channel sandstones, the absence of color-banding and the abundance of impure, gypsiferous lignite at many horizons in the shales. Some of the thicker lignite beds have attracted attention among the local ranchmen as a source of blacksmith's coal.

With the exception of a few scraps of bone, no vertebrate fossils have been found in the Tatman formation. The invertebrates suggest that its age is probably Eocene and possibly Bridger.

The only change in our previously published diagrammatic section across the Bighorn basin [2] necessitated by the work of the past summer is the separation from the Wasatch of 400 to 600 feet of beds immediately beneath the Lambdotherium zone, which, it is now believed, belong to the Lysite.

NEW FACTS REGARDING THE LITHOLOGY OF THE TERTIARY SEDIMENTS.

Gravel Beds.

The discovery of thick gravel lenses in the Knight, Lysite and Lost Cabin formations is one of the most important additions to our knowledge of the lithology of the Tertiary sediments of the Bighorn basin, for it demonstrates conclusively that their source is the older rocks of the surrounding mountains.

Gravel lenses interstratified with coarse yellow-brown sandstone occur in the Knight formation on the south side of Dry Creek, northwest of Fenton where they overly clays affording *Systemodon*. They have been seen at many localities in the Lysite and Lost Cabin formations throughout Buffalo Basin (Plate VI) where the pebbles seem to increase in size toward

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[1] *Loc. cit.*, p. 34.

[2] Bulletin American Museum, Vol. XXX, Article VII, Fig. 2B.

the south and southwest, due, undoubtedly, to the fact that we are there approaching the source of supply of the material composing the gravels. Almost without exception, the pebbles are quartzite or chert, well rounded, but sometimes flattened with the flat surfaces lying parallel to the bedding planes of the lens (Plate VI). The matrix is coarse sand with calcareous or ferruginous cement. In one of the chert pebbles from a gravel lens in the Wind River near the Perkins ranch on the north side of Gooseberry Creek, a fragment of a coral resembling *Favosites* was found. Pieces of silicified wood were also noted in this conglomerate. These gravels are, unquestionably, channel deposits laid down by the streams which drained from the mountains during the Eocene and supplied the clays, sandstones and gravels to the intermontane trough. Gravels predominate in the southwestern portion of this trough simply because the Lysite and Lost Cabin formations, in which they occur most abundantly, have been removed by erosion farther east by the deep cutting of the Bighorn, but the absence of gravels from the easterly exposures of the Knight formation is rather remarkable.

DATE OF THE EOCENE DEFORMATION IN THE BIGHORN BASIN.

As Wind River fossils have not yet been found in either the Elk Creek anticline or the McCulloch Peak syncline, it cannot be determined whether these marginal flexures were produced during, before or after Wind River time. That they were probably later is suggested by the fact that the Tatman formation on the Gooseberry-Fifteen-mile Creek divide, overlying what is probably the Lost Cabin formation, has been tilted up with the latter, dipping toward the center of Buffalo Basin. It may well be that this accentuation of centripetal dips was contemporaneous with the development of the marginal flexures and that both were due to a common cause. Minor flexures have been noticed in the Lost Cabin formation on the divide between the Gray Bull and Fifteen-mile Creek north of Parker Spring.

DATE OF DISSECTION OF THE BASIN DEPOSITS.

Where the Shoshone River cuts through the Eocene clays west of McCulloch Peak, the lower terraces along the river are covered with water-worn pebbles and boulders of volcanic origin, mainly andesitic. When representatives of pre-Tertiary rocks occur they are always well-rounded.

At higher levels, the character of the terrace-mantle changes completely. Here nothing but highly angular rain-etched fragments of Palæozoic limestone are to be found varying in diameter from an inch or less to masses several feet across. Such fragments form a veneer on the tops of the higher terraces out in the badland clays, but they also occur far above the level of recognizable terraces on the tops of narrow ridges, 6000 feet above sea level, in the tremendously rough badland country to the west and southwest of the westerly summit of McCulloch Peak. That we are dealing with Palæozoic limestones and not the residual fragments of a Tertiary deposit is shown by the fossil corals and bryozoa which were repeatedly seen weathering out in relief on the solution-etched surfaces. Not a fragment of any rock other than limestone has been seen in these higher terraces and no waterworn material of any kind. High up on the west slope of McCulloch Peak an east-west-trending ridge of these angular blocks crosses the badlands. The ridge is six feet or more high and blocks, large and small, are piled up together in a symmetrical rampart. A similar mass is cut across by the river cliff east of Corbett station. The limestone blocks, falling over the cliff, have formed a talus high above the river, readily distinguishable from the rain-washed slopes of the surrounded clays. The nearest ledges of Palæozoic limestone are at least fifteen miles to the westward and yet blocks several cubic feet in volume have been carried out from the mountains, across the basin-filling of Eocene clays before the initiation of the erosion which has so deeply dissected it, and dropped without any attempt at assortment according to size, large and small together, and without any sign of water-wear. One block near Peter Miller spring measures approximately six by eight by three or four feet. In a cut bank at a level considerably above the lowest of the limestone-capped terraces highly angular fragments of the limestone were seen imbedded in soft, unstratified, yellowish silt, resembling boulder clay.

A brief statement of the facts observed was presented before the recent Washington meeting of the Geological Society of America and the transportation of the limestone blocks ascribed to glacial ice. Since then, correspondents have offered several alternative hypotheses, suggesting (1) that the fragments may represent a disintegrated remnant of an overthrust block of Madison limestone and (2) that they have been transported by water as claimed by Trowbridge[1] in explaining the transportation of the enormous blocks of granite found on the surfaces of the piedmont fans in Owens Valley. There is no evidence for such extensive overthrust of the Palæozoic series on the Eocene as the first of these suggestions necessitates and, for the second, it seems difficult to assume aqueous transportation without postulating far steeper surface gradients than seem to have existed previous to the dissection of the Eocene basin filling.

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[1] Arthur C. Trowbridge. The Terrestrial Deposits of Owens Valley, California, Journal of Geology, Vol. XIX, pp. 706–747, 1911.

The narrow-crested boulder ridges, high up in the badlands, suggest moraines. The terraces, capped only with angular fragments of limestone, suggest lacustrine conditions and the transportation of the fragments by floating ice. Unfortunately the problem must be left, for the present, in this most unsatisfactory condition, for lack of time and the palæontological objects of the expedition made it impossible to give it the attention which it deserves.

Since the limestone blocks were deposited over the floor of the Eocene basin, a tremendous amount of dissection has taken place, resulting in the maze of canons trenched in the McCulloch Peak mass and leaving isolated limestone blocks perched high up on narrow comb-ridges far above the present valleys. This dissection may possibly be an event of Pleistocene time.

That considerable erosion may have occurred in the Bighorn basin as a whole previous to the deposition of the limestone blocks is suggested by the absence of the Tatman formation and its overlying gravels in the McCulloch Peak area, where, as already stated, the limestone blocks rest directly on the red-banded pre-Tatman clays. This does not alter the situation, however, in regard to the cañon-cutting since these gorges have been cut in the clays beneath the limestone-block capping. That this is younger than the andesitic stream gravels on the top of Tatman mountain seems probable. These high-level andesitic gravels apparently antedate the dissection of the basin and are a remnant of a gravel sheet spread over the floor of the basin at the close of its depositional history. They must not be confused with the low-lying volcanic gravels found along the Shoshone River and elsewhere. These are much younger than the limestone-capped terraces. Such limestone fragments as occur in them are invariably waterworn.

RÉSUMÉ.

1. The Lower Eocene sediments of the Bighorn basin represent the alluvial filling of an intermontane trough of downwarp.

2. They have been transported from the surrounding mountains as shown by the lithology of the gravels, sands and clays. No volcanic ash occurs.

3. They are stream transported and have been deposited in stream channels or spread over flood plains. No evidence in favor of wind transportation has been observed.

4. The Eocene clays are banded in more or less regular alternation, red and blue. This may be due to climatic causes leading to concentration of iron salts and their oxidation.

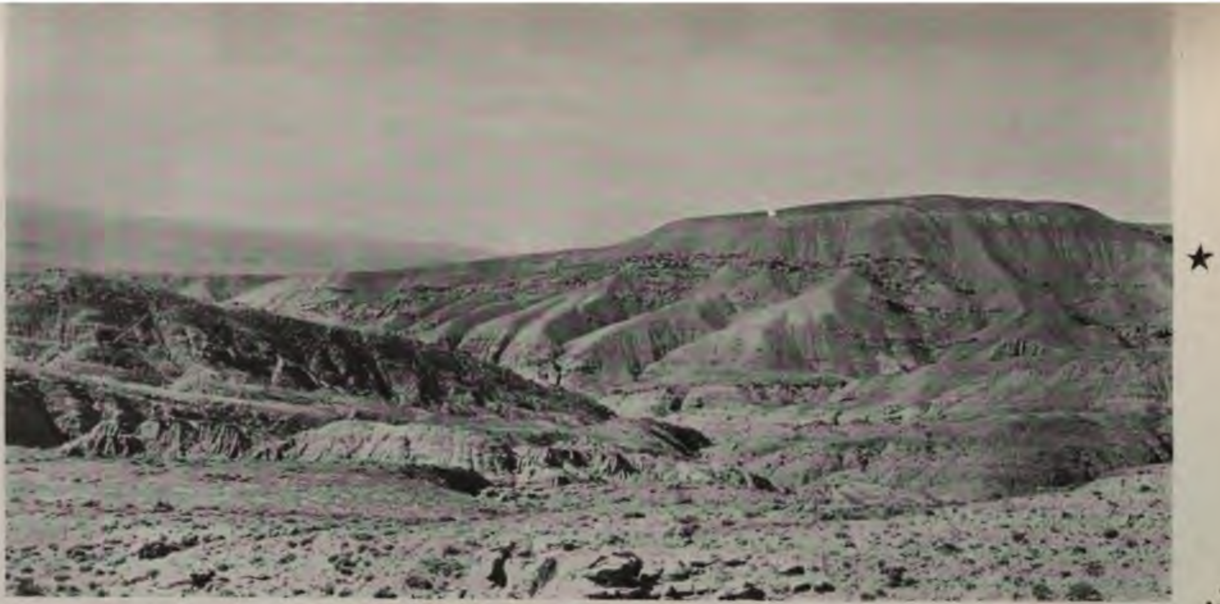
5. The beds are divisible into three formations, the Knight, Lysite and Lost Cabin, readily separable by their fossils, but not differing lithologically and conformable throughout. The Wind River (comprising the Lysite and Lost Cabin) is confined to the southwest portion of the basin (McCulloch Peak possibly excepted) and has been removed elsewhere by erosion.

6. The Lower Eocene formations are overlain conformably by another set of beds, containing much lignite, the Tatman formation, in which determinable vertebrate fossils have not yet been found. Invertebrate fossils suggest that it may be of Eocene age, possibly Bridger.

7. The Tatman formation is overlain by andesitic gravels of doubtful age, of which but a remnant on the top of Tatman Mountain is preserved in place.

8. Deformative stresses have acted on the basin filling after the deposition of the Tatman formation, flexing it into marginal anticlines and synclines and increasing the centripetal dip of the beds.

9. The major dissection of the basin is, probably, a comparatively late event, geologically speaking, perhaps referable, in part, to the Pleistocene.



Contact of so-called Fort Union with Wasatch on the southwest slopes of McCulloch Peak. The fauna listed on p. 59 was collected on the two benches seen in the dipping beds at the left hand side of the picture. The star indicates the position of the banded Wasatch clays.

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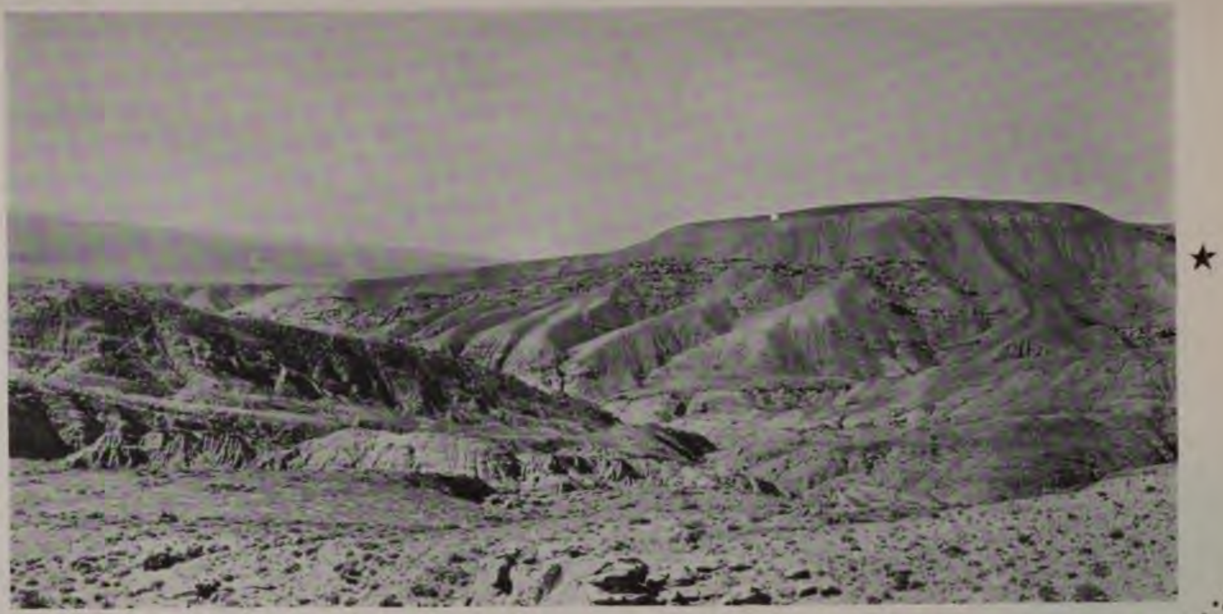

Contact of so-called Fort Union with Wasatch on the southwest slopes of McCulloch Peak. The fauna listed on p. 59 was collected on the two benches seen in the dipping beds at the left hand side of the picture. The star indicates the position of the banded Wasatch clays.

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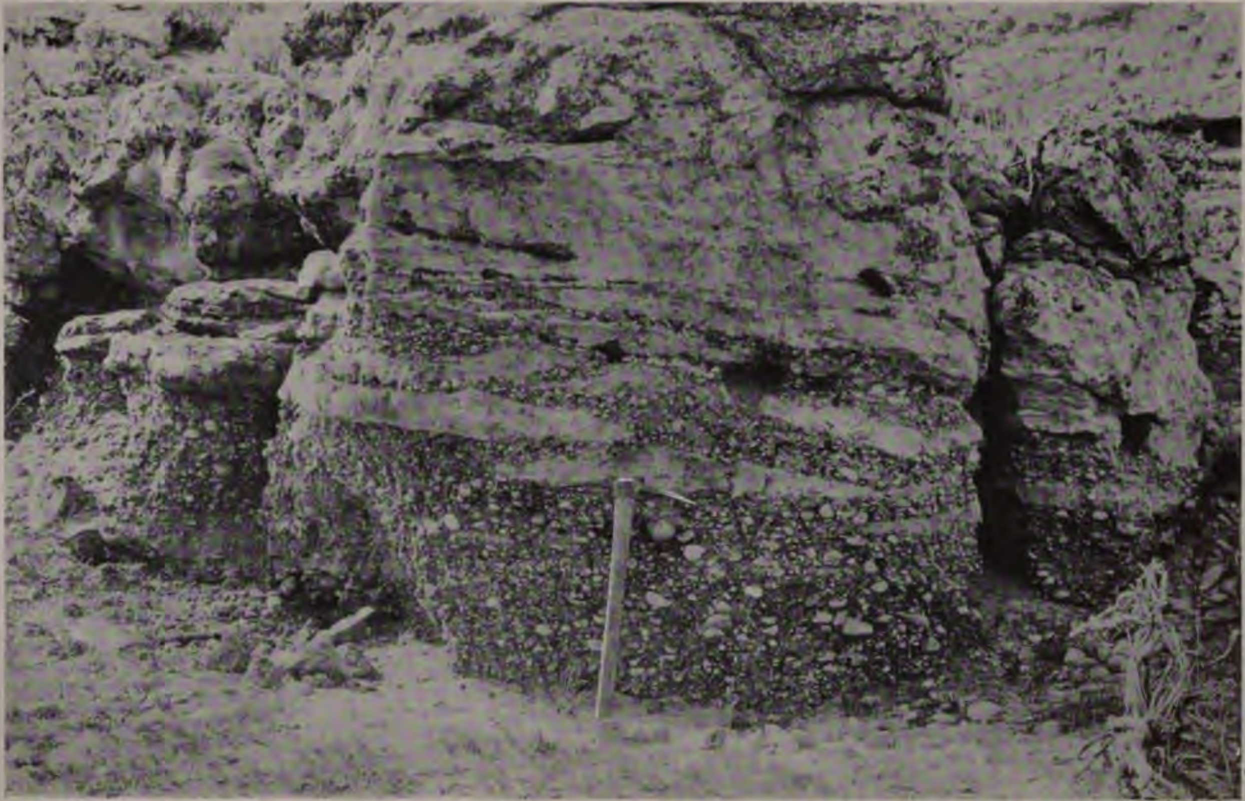


Gravel lenses in Wind River sandstones (probably Lost Cabin formation) about two miles east of Perkins's Ranch, on the south side of Gooseberry Creek.

56.4,1M(79.8)

Article VI.— AN UNUSUAL SPECIMEN OF *MYTILUS MIDDENDORFFII* GREWINGK, FROM ALASKA.

By L. P. Gratacap.

Plate VII.

About two years ago Mr. Alfred H. Dunham of Nome, Alaska, brought to me a molluscan fossil, received by him from an old Spanish sea captain of the name of de Soto, who had found it on one of the islands of the Alaskan Peninsula. Its excellent preservation, the strongly accentuated features of age, seen in it, and an apparent newness in its specific character, at least, gave it an especial interest. Later examination confirmed the impressions of its unusual character, and its identification as *Mytilus middendorffii* Grewingk was made by Dr. Dall.

The fossil is that of a lamellibranch shell, consisting of the right and left valves which have been separated, and somewhat displaced from their original relative positions, the movement tearing apart the ventral edges, slightly reversing or deflecting the umbones, and disclosing the interior filling of gravel-like cement, in which quartz grains are abundant and which shows a probably coarse clastic sedimentation in the matrix formation from which this shell was taken.

A superficial glance provoked the first suspicion that the shell belonged to the Mytilidæ and might indeed be a *Modiola*. The nucleal shell had a mytiloid shape, but the development of a short rounded shelly cord or ridge (bourrelet), curving from the apex to the edge of either valve appeared abnormal. The shell had developed very marked old-age characters, and its extended numerously ridged or corded and voluminous ventral areas, formed evidently a dependent pouch-like extension beyond the original oblong or elliptical outlines of the younger shell. Dr. Dall's letter disclosed its exact reference. He wrote:

"Your fossil is a much distorted specimen of the Miocene *Mytilus middendorffii* Grewingk, described in his book on the Geology of N. W. America. Normally it is like most other *Mytili* except that it has three wide plications distally, but your specimen has grown in an arcuate shape and something or other has made it have exaggerated resting stages, like *Botula cinnamomea:* the dental ridge near the beak, which is present in all *Mytili* is exaggerated and made conspicuous by the arcuation. There is another species very like it in the Pliocene of Oregon which I named after

Dr. Condon of the State University. I don't wonder you did not recognize it as a *Mytilus*, as the distortion is exceptionally great, and the beast evidently had a hard life of it."

The alteration of the typical shell produced by distortion, abnormal development, old age, and perhaps interrupted though persistent growth, merits a record at least as displaying an interesting phase in fossil molluscan disfiguration. The specimen may be described as follows:

Shell oblong, quadrate, slightly protuberant posteriorly, swollen at beaks, becoming in old age sacciform; apical outline mytiloid, elevated dorsal center with curving descending edge becoming inflected or carinate in old individuals, through arcuation, half way to the inferior limits of the shell, the lower half (in the specimen a gerontic feature) forming a columnar cavity, compressed and throughout striate with undulating lines of growth. Surface at first smooth with undulating lines of growth which are strengthened at successive intervals into shoulders or semi-salient folds, which become crowded, later producing a coarsely striate surface. Shell crossed by evident anterior-posterior furrows or plications forming with the lines of growth more or less obsolescent nodes, these latter more noticeable in the earlier periods of the shell. Apparently, in the specimen described, constriction developed as the shell increased in size and its ventral edge lengthened, making a lateral shallow concavity. The "dental ridge" is very conspicuous, being a round thickened crest or cord, developed like a fold, leaving the anterior angle of the umbo, and turning backward in a semicircle. The strong sculpture or successional ridges or capes over the surface of the valves is unusual, and if persistent in many individuals would almost constitute a varietal feature as also the humped up effect of the dorsal outlines. When compared with Grewingk's figures the identity of the two phases is not striking, and might indeed not be even suspected, though it is also obvious that the plicate and sulcate surfaces of the former admit, in extreme growth, of almost inevitable distortion.

Grewingk's specimens came from Tonki Cape and Igatskoi Bay, on Kadiak Island; de Soto's specimen was picked up on the hills forming the medial ridge of the Alaskan peninsula near Cape Seniavin.

Description of the Plate.

Fig. 1. Dorsal view of specimen showing distortion and extension of the shell and ridgy striation. Nat. size.

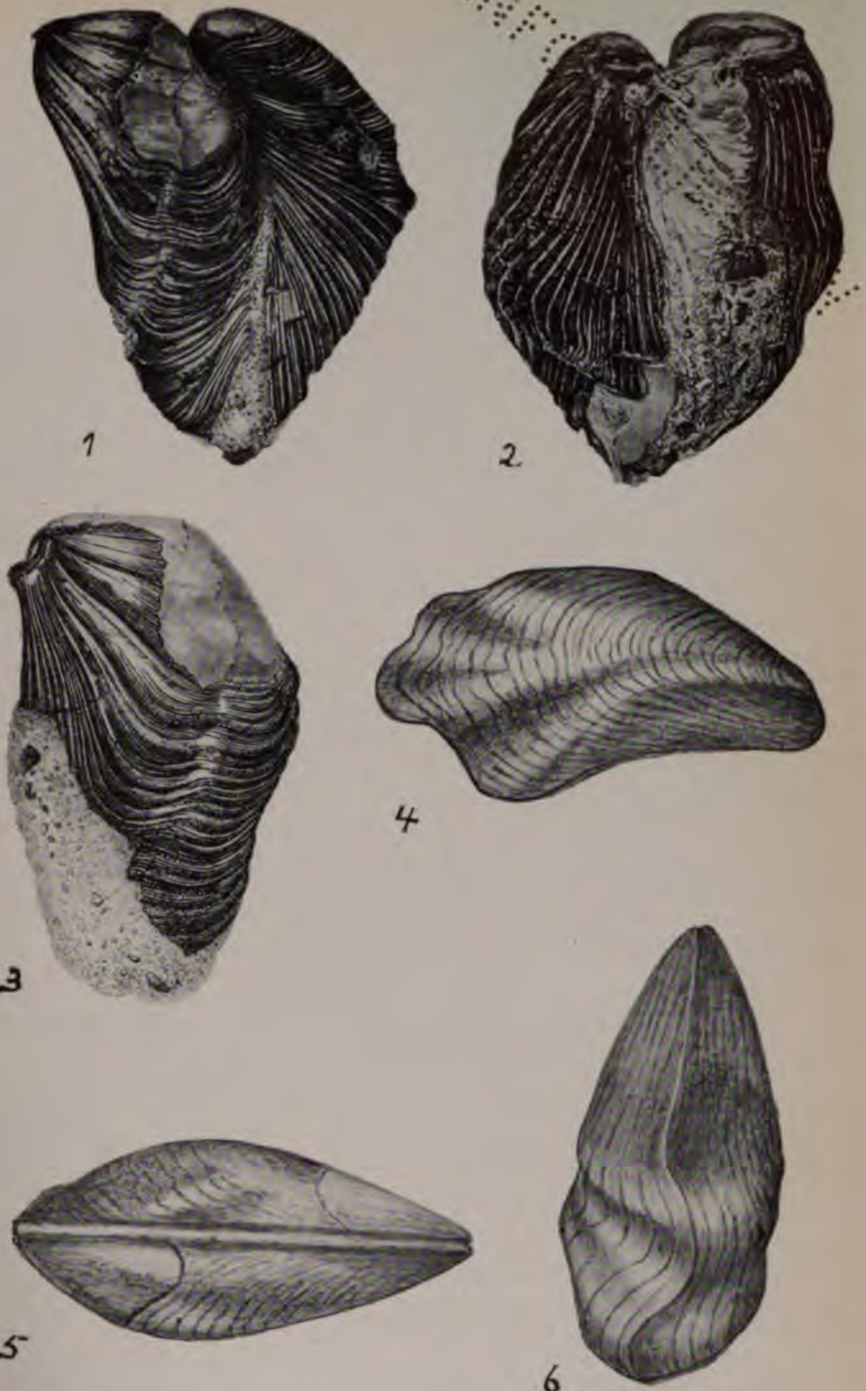
Fig. 2. Ventral view of specimen showing separated umbone, and the strong "dental ridge." Nat. size.

Fig. 3. View of one valve showing "dental ridge," and the prominent growth stages. Nat. size.

Fig. 4. *Mytilus middendorffii* (from Grewingk).

Fig. 5. Dorsal view (from Grewingk).

Fig. 6. Ventral view (from Grewingk).



DISTORTED SPECIMEN OF *Mytilus middendorffii* GREWINGK.

59.9(86)

Article VII.— MAMMALS FROM WESTERN COLOMBIA.

BY J. A. ALLEN.

The present paper is based on a collection of mammals, numbering about 400 specimens, representing 55 species, made in the Cauca district[1] of western Colombia during November and December, 1910, and the first six months of 1911, by an expedition sent out by this Museum for the purpose of collecting birds and mammals and studying the life zones and environmental conditions of this highly diversified and hitherto little studied portion of South America. Mr. William B. Richardson, formerly employed by the Museum as a collector in Nicaragua, was engaged for a year to begin what was hoped to be a thorough biological survey, so far as bird and mammal life was concerned, of the Andean region of southwestern Colombia. He reached Buenaventura early in November, and worked for several weeks in the humid coast belt, from sea level to about 2000 feet, and later in the Western Andes and the Cauca Valley, chiefly at altitudes of from 5000 to 10,000 feet.

Mr. Frank M. Chapman, Curator of Ornithology, who planned the expedition and has directed its work,[2] joined Mr. Richardson in the field March 27, 1911, accompanied by Mr. Leo E. Miller, and Mr. Louis A. Fuertes as artist, since to gather material and make the necessary field studies for a habitat group to illustrate the bird life of the higher Andes was one of the primary objects of the expedition. Mr. Chapman was thus able to plan the future field work from personal knowledge of the region, and after two months' of reconnaissance work returned to New York with Mr. Fuertes, leaving Messrs. Miller and Richardson in the field.

As already stated, this report on the mammals is based on the collections made prior to the end of July, 1911. The results of the following six months work, numbering about 400 additional specimens of mammals, are in transit to the Museum.[3] These will form the basis of a second paper on the Mammals of the Museum's Colombian Expedition. The report on the birds, by Mr. Chapman, is well advanced in preparation, and will comprise a more detailed account of the field work of the expedition.

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[1] With the exception of a few species collected along the Rio San Jorge, to the northward in Bolivar Department.

[2] Mr. Chapman had been contemplating an expedition to this region since the late Mr. J. H. Batty, in 1898, brought to this Museum a small collection of birds and mammals gathered by him in the Upper Cauca Valley, but lack of funds has rendered it necessary to defer the enterprise from year to year awaiting favorable conditions.

[3] Since this was written they have reached the Museum, and a preliminary examination of the collection shows that the species represented are in the main additional to those previously received.

The principal localities at which mammals were collected are the following:

By Richardson.

San José, coast belt, altitude (at which collections were made), 200 feet, Nov. 29–Dec. 13, 1910.

Los Cisneros, 600 feet, March 17–21.

Caldas, altitude 2000 feet, east of San José, Nov. 18–21.

San Antonio, altitude 7000 feet, Jan. 4–March 31, 1911 (on the Cali River, near Cali).

Las Lomitas, altitude 5000 feet, Feb. 26–March 13.

By Miller.

Mira Flores, altitude 6200 feet, April 18–May 1 (Central Andes near Palmira).

Munchique (Cerro Munchique), 6000–8325 feet, May 24–June 11.

Cocal, 4000–6000 feet, June 10–17.

Gallera, 5700 feet, June 28–July 13.

La Florida, 7000 feet, July 8–18.

Crest of Western Andes, 40 miles west of Popayan, 10,340 feet, July 3–24.

San José, Los Cisneros, and Caldas are in the torrid coast belt; Mira Flores is on the western slope of the Central Andes, near Palmira; Munchique, Cocal, Gallera, La Florida, and "Crest of Western Andes," are all near Popayan, and all are on the western slope, near the crest, except La Florida, which is east of the crest.

The region which includes these localities has heretofore been only superficially examined. A few mammals obtained by Mr. J. H. Batty in 1898 have formed the basis of several species described by Mr. Oldfield Thomas, Mr. E. W. Nelson, and the present writer, and Mr. Thomas has described several species collected in the coast belt (Chocó district) by Mr. M. G. Palmer in 1908.

Other neighboring localities, wholly outside of the area of the present paper, at which mammals have been previously collected, are northern and northwestern Ecuador (Esmeraldas, Quito, etc.) to the southward and westward, and western Cundinamarca and the Bogota district to the eastward and northeastward, from which a few species have been described, but from which districts no very large collections have been received.

Considering the great diversity of environment presented in southwestern Colombia, due to great differences in altitude and precipitation at even contiguous localities, and the merely superficial and sporadic field work hitherto done here, it is not surprising that thorough collecting by modern methods has disclosed a large number of hitherto unrecognized forms of mammal life, which it has seemed necessary to describe in the present paper. Further material will doubtless show that several others here provisionally referred to previously known species will require new designations. In the present paper the following 18 forms have been characterized as new:

Sylvilagus fulvescens.
Heteromys lomitensis.
Reithrodontomys milleri.
Rhipidomys mollissimus.
" similis.
" cocalensis.
Thomasomys cinereiventer.
" popayanus.
Neacomys pusillus.
Oryzomys palmiræ.
" pectoralis.
" (Oligoryzomys) munchiquensis.
" " fulvirostris.
" (Melanomys) obscurior affinis.
Microxus affinis.
Æpeomys fuscatus.
Sciurus milleri.
Blarina (Cryptotis) squamipes.

DIDELPHIIDÆ.

1. **Marmosa phæa** *Thomas.*

One specimen, adult male, without skull, Las Lomitas (alt. 5000 ft.), Feb. 26 (Richardson). Doubtfully referred to this species.

2. **Marmosa murina zeledoni** *Goldman.*

Three immature specimens, without skulls, San José (alt. 200 ft.), Nov. 29 and Dec. 5 (Richardson). Doubtfully referred to this form.

3. **Thylamys caucæ** (*Thomas*).

One specimen, San Antonio (alt. 7000 ft.), subadult male, Jan. 12 (Richardson). This specimen is from very near the type locality of the species.[1]

4. **Metachirus opossum melanurus** *Thomas.*

Two specimens (one a skull only), Cocal (alt. 4000 ft.), July 12 (Miller). The skin greatly resembles *M. opossum fuscogriseus* Allen but it is darker with the tail wholly black to the tip. *M. griscescens* Allen, from the Upper Cauca Valley, is a quite different animal, but related to the *M. opossum* group, of which further material may show it to be a subspecies.

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[1] *Marmosa caucæ* Thomas, Ann. and Mag. Nat. Hist. (7), V, Feb. 1900, p. 221.

5. **Didelphis paraguayensis andina** *Allen.*

Twelve specimens, 4 adult and 8 young, Munchique (alt. 8225 ft.), May 25–June 6 (Miller). All but two are in the black phase.

6. **Didelphis marsupialis etensis** *Allen.*

Three specimens (Richardson): San José (alt. 200 ft.), Dec. 5 and 13, 2 young specimens; Caldas (alt. 2000 ft.), 1 adult female.

7. **Chironectes minimus** (*Zimmermann*).

Two specimens: Juanchito (alt. 3500 ft.), adult male, Aug. 13 (Miller); flat skin, purchased, Palmira (Richardson).

Juanchito specimen: total length, 695; tail, 390; hind foot, 66. Skull, total length, 725; zygomatic breadth, 43.

BRADYPODIDÆ.

8. **Bradypus ephippiger** *Philippi.*

Two specimens, adult male and female, Rio San Jorge, Dec. 12 and 20 1911 (Mrs. E. L. Kerr).

DASYPODIDÆ.

9. **Dasypus**[1] **novemcinctus** *Linnæus.*

One specimen, Munchique (alt. 7000 ft.), June 11 (Miller).

CERVIDÆ.

10. **Mazama tschudii** (*Wagner*).

Two specimens, adult female and young male in spotted coat, Gallera (alt. 5700 ft.), July 2 (Miller).

These specimens are referred provisionally to this species.

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[1] On the use of *Dasypus* in place of *Tatu*, *cf.* Thomas, Proc. Zool. Soc. London, 1911, p. 111.

LEPORIDÆ.

11. **Sylvilagus (Tapeti) fulvescens** sp. nov.

Type, No. 32360, ♀ ad., Belen (alt. 6000 ft.), Western Andes, July 28, 1911; coll. Leo E. Miller.

Much smaller than either *S. andinus* or *surdaster* Thomas, from Ecuador, described respectively from the coast region and the Eastern Andes.

General color above pale fulvous varied slightly with black, the fur being slaty basally, then narrowly banded with black, followed by a broad band of buff, with rather inconspicuous brownish black tips; top of nose with a broad band of pale grayish buff varied with black-tipped hairs, becoming pale rufous on the frontal region; chin, throat, pectoral region and middle of abdomen white, passing into a pale buff tint laterally and on the inside of the hind limbs; prepectoral band very pale buff; the hairs of the whole ventral surface are grayish plumbeous at base; ears pale rufous on both surfaces, as is the nape patch; fore and hind feet yellowish rufous, the soles dusky; the very short tail is dusky above, pale yellowish rufous below.

Total length (type and only specimen), 328; tail, 20; hind foot (c. u.), 81 (s. u. 73); ear (in dry skin), 40. Skull, greatest length, 61.5; zygomatic breadth, 31; mastoid breadth, 24; interorbital breadth, 13; length of nasals (diagonally), 25, greatest breadth, 13.5; palatal length, 23; breadth of palate, 10; palatal foramina, 10 × 5; upper tooth-row (at alveolar border), 12; greatest antero-posterior diameter of bulla, 9.4.

The type is a fully adult female, with the sutures of the skull well closed. The frontal region is flat but not concave interorbitally; the postorbital processes are small, narrow and pointed and diverge from the braincase. The general coloration above is a dull pale shade of yellowish.

The geographically nearest known relatives of *S. fulvescens* are *S. surdaster* Thomas from the low coast district of Ecuador (dark-colored with blackish ears and very small bullæ), and *S. andinus* from the Eastern Andes (Mount Cayambé, at an altitude of over 13,000 feet), also dark colored with the ears gray at base and blackish apically. Both considerably exceed the present species in size, and differ strongly from it in coloration.

AGOUTIDÆ.

12. **Agouti paca virgata** *Bangs.*

One specimen, nearly adult female, San José (alt. 200 ft.), Dec. 3, 1910 (Richardson).

Total length, 660; tail, 0; hind foot, 130. Skull, occipito-nasal length, 139; zygomatic breadth, 83; nasals, length on mid-line, 47; greatest breadth, 25; frontals, length on mid-line, 59; breadth at posterior border, 58; interorbital breadth, 38; greatest breadth of occiput, 59; length of upper toothrow at alveolar border, 32.

In coloration and in the form of the skull this specimen agrees with a series from Nicaragua which I refer to *virgata*.

13. **Agouti paca** subsp. indet.

One specimen, La Florida (alt. 7000 ft.), July 18 (Miller).

This is a young male with the milk premolars still in place. In coloration and markings it agrees well with Stolzmann's description of *Cœlogenys taczanowskii*, but, though still young, is a much larger animal, both in external and cranial measurements. *A. taczanowskii* is a mountain form, living, according to the describer, on both slopes of the Andes in Ecuador between 6000 and 10,000 feet. His type is stated to be an apparently adult male. It is certainly much more mature, although much smaller, than the present specimen from La Florida. Until further material is available it is impossible to decide upon the relationship of the two forms.

14. **Dasyprocta variegata variegata** *Tschudi*.

Two specimens, males, Los Cisneros (alt. 600 ft.), March 19 and 21 (Richardson). One is adult, the other still retains the milk premolars.

Indistinguishable from a specimen from the Rio Oscuro, Cauca Valley, collected some years ago by the late J. H. Batty. They also agree very closely with a number of specimens in a large series of *D. columbiana* Bangs from Bonda, Santa Marta, Colombia. The Bonda series shows a wide range of individual color variation, especially in the amount of ochraceous in the dorsal pelage, and in the white-tipping of the hairs of the lower back. The description of *D. columbiana* was based two immature specimens, and no comparison appears to have been made with *D. variegata*; it seems to be at best a slightly differentiated subspecies of the *variegata* group, and should apparently stand as *D. variegata columbiana*. The basal length (189.4) of the type skull of *columbiana* is obviously an error; probably 189.4 should read 89.4.

OCTODONTIDÆ.

15. **Proechimys semispinosus calidior** *Thomas*.

Fourteen specimens (Richardson), Nov. 29–Dec. 11, 1911; 10 adults, 4 young one fourth to one half grown. The young specimens have the whole back dark brown, the flanks strongly washed with ferruginous.

Mr. Thomas's description [1] of this subspecies agrees perfectly with these specimens, which were collected in the coast region of Colombia, about 100 miles north of the type locality of *calidior*, in the same character of country.

Measurements of 8 adults: Total length, 370 (340–400); head and body, 218 (210–240); tail, 168 (150–185); hind foot, 53.3 (50–55). Skull (average of several adults), total length, 57; zygomatic breadth, 27.

HETEROMYIDÆ.

16. **Heteromys lomitensis** sp. nov.

Type, No. 32240, ♀ ad., Las Lomitas, Cauca, Colombia, March 1, 1911; coll. W. B. Richardson. Altitude 5000 feet, west slope of Western Andes.

Upperparts superficially dull black, the hairs without either rufous or fulvous tipping; both spines and hairs grayish white basally, black apically, with a few white-tipped hairs and spines intermixed; ventral surface, inside of limbs, muzzle, lower border of cheeks and cheek-pouches white; fore feet white; hind feet thinly covered with silvery white hairs nearly to ankles; soles naked, black; tail indistinctly bicolor, dark brown above, lighter below, nearly naked; ears dark brown.

Type, total length, 250 mm.; head and body, 120; tail, 130; hind foot (c. u.), 30. Skull, total length, 35; zygomatic breadth, 16; length of nasals, 14; interorbital breadth, 9; diastema, 8; upper toothrow, 4.2.

Represented by three adult specimens (two males, one female), all from the type locality, March 1–4, 1911.

This species is nearly related to *Heteromys australis* Thomas, from near sea level at St. Javier, Lower Cachabi River, northwestern Ecuador, from which it differs in darker coloration and smaller size.

MURIDÆ.

17. **Mus musculus** *Linnæus.*

Seven specimens (Richardson): San José, 1 specimen, Dec. 7; Caldas, 6 specimens, Nov. 18–20.

18. **Reithrodontomys milleri** sp. nov.

Type, No. 32596, ♂ ad., Munchique (alt. 8325 ft.), Cauca, Colombia, May 28, 1911; coll. Leo E. Miller, for whom the species is named, in recognition of his excellent field work in collecting the mammals which to a large extent form the basis of the present paper.

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[1] Ann. and Mag. Nat. Hist. (8), VIII, Aug., 1911, p. 254.

Upperparts yellowish brown, darker mesially, lighter and more fulvous on the sides and passing into the deep orange-buff lateral line which sharply divides the dorsal from the ventral surface; underparts white or grayish white, the hairs basally gray, this color often tinging the surface; ears dull brown; upper surface of all the feet dusky brown, the digits flesh-color or whitish; tail bicolor, dark brown above, grayish brown below, not lighter at the tip.

Type, total length, 185; head and body, 78; tail, 107; hind feet (c. u.), 19. Ten adults (all topotypes): total length, 181 (169–190); head and body, 73.8 (70–78); tail, 107 (98–116); hind foot, 19 (18–20). Skull, total length, 23; zygomatic breadth, 11.5; interorbital breadth, 4; breadth of braincase, 11; mastoid breadth, 10; length of nasals, 8; diastema, 5; upper toothrow, 4.

Type, an adult male. Represented by 17 specimens (Miller), of which 15 are from Munchique (May 24–June 8), and 2 from Cocal, June 17. The adults show a considerable range of individual color variation, the type representing the average coloration. Above the general coloration varies from yellowish brown to rufous brown; below from clear white to grayish white, only one specimen out of the whole series showing a faint tinge of cream buff. Immature specimens are dusky grayish brown above with a slight yellowish tinge tipping the hairs.

Compared with *Reithrodontomys söderströmi* Thomas, from Quito, Ecuador, the present species is fulvous brown instead of "grayish fawn" above, clear white or grayish white instead of "more or less buffy or fawn-colored below," with a well developed lateral line, the feet and hands more or less dusky above (blackish in young specimens) instead of "white, without darker markings on the metapodials," and the tail not white-tipped.

19. **Rhipidomys mollissimus** sp. nov.

Type, No. 32243, ♀ ad., Mira Flores (alt. 6200 ft.), west slope of Central Andes, near Palmira, Cauca, Colombia, April 30, 1911; coll. Leo E. Miller.

Upperparts yellowish brown inconspicuously grizzled with blackish, the hairs being dark slate basally with a narrow apical or subapical band of fulvous, and a slight tipping of black on the middle of the back; top of head scarcely different from the back; a well marked lateral line of deep buff separating the dorsal and ventral surfaces; underparts yellowish white, the hairs white to the base with the tips washed with pale yellowish; ears dull brown; tail black, unicolor, nearly naked basally, scantily clothed with short black hairs towards the tip, nearly concealing the annulations, and forming a conspicuous tuft at the tip; fore feet externally buffy, toes not conspicuously lighter; hind feet with buffy edges and toes, the median area dull black.

Type, total length, 279; head and body, 123; tail vertebræ, 156; hind foot (c. u.), 27; ear (in skin), 15. Skull, total length, 32; basilar length, 25; zygomatic breadth, 17; length of nasals, 11; interorbital breadth, 5; breadth of braincase, 14; mastoid breadth, 12.6; palatal length, 12; diastema, 7.5; upper toothrow, 5.

Pelage short and fine, exceedingly short and downy on the ventral surface.

The type and only specimen is an adult female; mammæ 1–2 = 6.

This species seems to bear some resemblance to *R. fulviventer* Thomas, but is about one fourth larger, has a well-defined lateral line, and is much paler below, where the hairs are not slaty at base as in *R. fulviventer*.

20. **Rhipidomys similis** sp. nov.

Type, No. 32458, ♂ ad., Cocal, Cauca, Colombia, June 17, 1911; coll. Leo E. Miller. Altitude, 6000 feet.

Similar in coloration of upperparts to *Thomasomys popayanus*; ventral surface grayish white washed with pale fulvous; ears brown, well covered on both surfaces with blackish hairs; feet with the upper surface dark brown, in the hind feet nearly black, the toes conspicuously white; tail dark brown, covered with black hairs, nearly concealing the annulations on the apical half, with a heavy terminal pencil.

Type, total length, 340; head and body, 165; tail, 185; hind foot, 31. Average of 4 adults (type and three topotypes), total length, 326.5 (320–340); head and body, 142 (128–165); tail, 190 (184–192); hind foot, 30 (29–31). Skull (type), total length, 34; zygomatic breadth, 18.5; nasals, 12; interorbital breadth, 5; breadth of braincase, 15.2; diastema, 8.5; palatal foramina, 6.4; upper molar series, 5.1.

Represented by 6 specimens, two of which have worn teeth and all are adult; four are from an altitude of 6000 feet and two from 4000 feet.

In general appearance externally *R. similis* looks like a pale-bellied diminutive of *Thomasomys popayanus*. It is, however, not only much smaller, but the ventral surface is grayish white with a wash of buff instead of being deep ochraceous buff; the amount of fulvous beneath varys in different specimens from a slight (practically absent in one) to a strong wash of pale buff. It is of course, readily distinguished from *popayanus* by the cranial characters and the well-haired and heavily tufted tail.

21. **Rhipidomys cocalensis** sp. nov.

Type, No. 32376, ♀ ad., Cocal, Cauca, Colombia, June 14, 1911; coll. Leo E. Miller. Altitude, 4000 feet.

Upperparts, except the head, uniform bright yellowish rufous, inconspicuously mixed with a few black-tipped hairs; entire ventral surface, inside of limbs, and lower half of cheeks pure white to the base of the hairs; head like the back, except more distinctly lined with black-tipped hairs; ears light brown, naked; tail brown, unicolor, nearly naked for the basal three-fourths; apical fourth well-clothed with short fine hairs, lengthening towards the tip and forming a well-developed apical tuft; fore feet flesh color; hind feet light with the metapodial area shaded with dusky. Soles brownish flesh color.

Type, total length, 360; head and body, 161; tail, 199; hind foot, 28. Skull, total length, 35; zygomatic breadth, 18; nasals, 12; interorbital breadth, 5.3; breadth of braincase, 15; diastema, 8.3; palatal foramina, 7; upper molar series, 5.

Represented by three immature specimens in addition to the type, which is a very old female with greatly worn teeth. Two of the young specimens are from Cocal and the other from Munchique. A half grown specimen has the upper parts dusky, quite blackish on the median line, and strongly washed with yellow on the sides and with a yellow lateral line. In the other young specimens the back is more or less mixed with black-tipped hairs.

This is a typical *Rhipidomys*, but I fail to recognize it among the described species.

22. **Thomasomys cinereiventer** sp. nov.

Type, No. 32436, ♂ ad., crest of Western Andes (altitude, 10,340 feet), 40 miles west of Popayan, Cauca, Colombia, July 14, 1911; coll. Leo E. Miller.

Similar in size and general proportions to *T. kalinowskii* (Thomas);[1] but differing in smaller ears and in coloration. Upper parts very dark brown, the hairs tipped with broccoli brown (Ridgway) instead of "dull yellow" as in *kalinowskii*; underparts ash gray with a barely perceptible wash of ecru drab (Ridgway), the hairs being slaty for their basal two-thirds, and tipped with soiled whitish; tail pale brown, not "black" as in *kalinowskii*, covered with short hairs and not pencilled; ears rather small, brown; upper surface of feet pale brown, much paler than the dorsal surface, the base of the nails with a tuft of silvery white hairs.

Type, total length, 304; head and body, 161; tail, 159; hind foot (c. u.), 36; ear (in dry skin), 14 × 12. Skull, total length, 36.5; zygomatic breadth, 18.5; breadth of braincase, 15; interorbital breadth, 6; length of nasals, 15; palatal foramina, 6; diastema, 10; upper toothrow, 5.5; lower jaw, condyle to tip of incisor, 23; coronoid to angle, 9.8.

The type is an old male, above average size, with slightly worn teeth.

Six topotypes, all old adults, the teeth in all showing appreciable wear, give the following: Total length, 299.3 (273–320); head and body, 137 (126–161); tail, 155 (144–172); hind foot, 35 (34–36); skulls, greatest length, 35.3 (34–37); zygomatic breadth, 18.1 (18–18.5). The average of this series varies but a few millimeters from the measurements given for the alcoholic type of *T. kalinowskii*, which are as follows: [Total length, 295;] head and body, 140; tail, 155; hind foot (s. u.), 32.8; skull, greatest length, 36; zygomatic breadth, 18.5.

A series of 20 specimens (13 males, 7 females) from the type locality, all adult but not of course of equal age, measure as follows: Total length, 281.8 (273–320); head and body, 131.4 (123–161); tail, 150.8 (144–162); hind foot, 34.6 (34–36); skull, greatest breadth, 35.5 (34–37); zygomatic breadth, 18.1 (17.3–18.5).

The young adults are much darker (nearly black) above and much clearer gray (silvery gray) below. The range of individual color variation in fully mature specimens is very slight, nor is there any appreciable sexual difference in size.

Represented by 22 specimens from the type locality (the crest of the Coast Range, west of Popayan, altitude 10,340 feet), collected July 10–28, 1911, and by 8 collected at Cocal (6000 feet), June 14–17. Several of the specimens of each series are not quite mature, but about five sixths in both series are fully adult, and several are old adults with worn teeth.

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[1] Ann. and Mag. Nat. Hist. (6), XIV, Nov., 1894, p. 349.

This species bears a striking general resemblance to *T. kalinowskii* from "the Valley of Vitoc, East Central Peru," from which it differs mainly in coloration, and much smaller ears.

23. **Thomasomys popayanus** sp. nov.

Type, No. 32371, ♂ ad., crest of Western Andes (alt. 10,340 ft.), 40 miles west of Popayan, Cauca, Colombia, July 17, 1911; coll. Leo E. Miller.

Upperparts yellowish rufous lined with black, a broad median dorsal band darker than the adjoining parts; more orange yellow on the sides; whole ventral surface and inside of limbs deep ochraceous buff from the throat to the base of the tail, the pelage plumbeous at the base; top of head darker than back and slightly grayish; sides of nose suffused with buff; cheeks like the sides; muzzle and chin ochraceous gray; upper surface of feet dark brown, the toes whitish; under surface of hind feet blackish brown; ears dull brown, nearly naked on both surfaces; tail dull grayish brown, unicolor, nearly naked (the very short hairs invisible without a lens), with a slight, barely distinguishable tuft at the end, as in many species of *Oryzomys*.

Type, total length, 374; head and body, 156; tail, 218; hind foot, 35. Skull, total length, 39; zygomatic breadth, 20; length of nasals, 15; interorbital breadth, 5; breadth of braincase, 17; diastema, 9; palatal foramina, 7; upper molar series, 7.

Represented by 14 specimens, all males, and all but one topotypes. The other is from San Antonio (alt. 8000 ft.), collected by Richardson, Jan. 10. All are adult, but three are slightly undersize in comparison with adults with worn teeth. Ten topotypes give the following measurements: Total length, 367 (348–395, only one specimen above 376); head and body, 156 (145–164); tail, 211 (201–218); hind foot (c. u.), 37.6 (35–38). Skull, total length, 38.2 (36.5–40); zygomatic breadth, 19.9 (19–20.5).

In coloration the series is unusually uniform, the chief difference being that the darker median band along the back is in some specimens barely distinguishable while in others (obviously younger specimens) it is strongly developed. The color of the ventral surface varies from buff to ochraceous buff; the grayish buff of the muzzle varies a little in the amount of buffy suffusion.

This species is apparently distinct from any other known species of the genus; it most resembles *T. princeps* (Thomas), from Bogota.

24. **Neacomys pusillus** sp. nov.

Type No. 31695, ♂ ad., San José, Cauca, Colombia, Dec. 9, 1910; coll. W. B. Richardson. Altitude, 200 feet, in the humid coast region.

Upperparts orange rufous finely grizzled with black-tipped hairs and spines, the orange tint strongly prevailing except on the lower back where the black-tipped spines predominate; sides lighter and more yellowish, a clear deep orange yellow band separating the dorsal and ventral surfaces and extending from the sides of the nose to the thighs; top of head much darker than shoulders and back; ventral surface wholly clear white to the base of the hairs, which are somewhat rigid; ears externally dark brown, scantily haired; inner surface with scattered short yellowish hairs; tail wholly dark brown and nearly naked; upper surface of feet with very short yellowish hairs; soles of hind feet naked, pale brown.

Type, total length, 145; head and body, 75; tail, 70; hind foot, 20. Skull, total length, 19; zygomatic breadth, 10; breadth of braincase, 10.3; length of nasals, 7.5; upper molar series, 2.5; diastema, 4.

Represented only by the type, an adult male with slightly worn teeth.

This species is similar in general coloration to *Neacomys spinosus* (Thomas), the type of the genus, from Huambo, in northern Peru, at an altitude of 3700 feet, but apparently less dark and more orange, with the color of the feet much lighter. It differs from it, however, strikingly in size, the skull being 4 mm. shorter in total length, and 3 mm. less in zygomatic breadth, with proportional differences in all external measurements. Geographically the localities are separated by the whole breadth of the Andean system, the present species being from the humid lowlands of the Pacific Coast.

In this connection a reëxamination of the series of 20 specimens collected by Mr. H. H. Keays at Inca Mines in southeastern Peru (lat. 13° 30′ south, long. 70° west, altitude 6000 feet) in 1900, and referred by me [1] to *Neacomys spinosus*, has shown that in all probability the Inca Mines series represents a well marked form of *N. spinosus*, characterized especially by its larger size. Excluding from this series several specimens that were without measurements or not fully mature, the remaining 15 specimens give the following measurements: Total length, 189 (184–203); head and body, 86 (76–95); tail, 103 (95–114). The measurements given for two specimens (type and topotype) of *spinosus*, from alcoholic specimens, reduced to millimeters, are [total length, 173.74 (174.99, 176.23)]; head and body, 76.2 (76.2, 76.2); tail, 99.4 (98.79, 100.03).

This large series from Inca Mines shows that the coloration of this group may present a wide range of individual variation, in some of these specimens the dorsal surface being blackish grizzled with rufous, in others orange rufous minutely punctated with black, the majority of the specimens varying between these extremes, irrespective of age or sex, the two specimens showing the greatest difference in coloration having been collected on the same day and at the same places. The ventral surface varies from deep buff to clear white. In some of the white-bellied specimens the whiteness extends to the base of the hairs, while in others the basal portion is more or less slaty gray, as is the case in all of the buff-tinted specimen.

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[1] Bull. Amer. Mus. Nat. Hist., XIII, 1900, p. 222, and XIV, 1901, p. 12

25. **Oryzomys palmiræ** sp. nov.

Type, No. 32224, ♀ ad., Mira Flores (alt. 6200 ft.), a few miles east of Palmira, eastern slope of Central Andes, April 30, 1911; coll. Leo E. Miller.

Pelage soft and fine, velvety on the ventral surface. Upperparts yellowish tawny-olive, finely grizzled with blackish on the back; sides, including cheeks, more yellowish; top of head darker and more varied with blackish than the back; ventral surface ashy white, sharply defined against the sides, the hairs dark gray basally broadly tipped with whitish; limbs externally like the sides, internally like the belly; upper surface of feet pale buffy white, without darker median area; ears dark brown, covered with very short hairs on both surfaces; tail gray brown, lighter below.

Type, total length, 215; head and body, 105; tail, 110; hind foot, 26; ear (in dry skin), 13. Another old female from Palmira, within sight of Mira Flores, but at nearly 3000 feet lower elevation, is slightly larger; a series of 8 subadults, partly from Mira Flores and partly from Las Lomitas, the latter at 5000 feet on the Western Andes, but only about 30 miles west of Palmira, are smaller, the difference being apparently due to immaturity. These average, total length, 197 (190–200); head and body, 99 (90–101); tail, 97 (90–100); hind foot, 25 (23.5–27).

Skull (type), total length, 27; zygomatic breadth, 15; interorbital breadth, 5; breadth of braincase, 12; length of nasals, 10; palatal length, 12; palatal foramina, 5; maxillary toothrow, 4.5; diastema, 6.2.

The type is an old female with worn teeth. Represented by 14 specimens, of which 5 are topotypes, 1 is from Palmira, 6 are from Las Lomitas, and 1 each from Cocal and the crest of the Western Andes. These localities include a range in altitude of from 3500 to 10,340 feet, and are distributed in and on both sides of the Cauca Valley. The variation in size and coloration seems to be correlated with age rather than locality, so that the recognition of more than one form in the present material seems undesirable.

Oryzomys palmiræ closely resembles in coloration, texture of pelage, and proportions *O. mollipilosus* Allen, from Santa Marta, Colombia, but is about one fourth smaller. The group to which these species belong has a wide distribution in Central and South America.

26. **Oryzomys pectoralis** sp. nov.

Type, No. 32561, ♀ ad., crest of Western Andes (alt. 10,340 ft.), 40 miles west of Popayan, Cauca, Colombia, July 10, 1911; coll. Leo E. Miller.

Above yellowish brown, slightly grizzled with black along the median line; sides clear yellow, forming a well-defined lateral line; top and sides of head blackish brown tinged with gray and slightly suffused with buff, much darker than back; ventral surface white, basal half of pelage grayish plumbeous, broadly tipped with white; *pectoral region pure white to the base of the hairs*; sides of nose, chin and sides of throat gray; ears dark brown, naked except on the basal portion externally; feet flesh-color, thinly covered with whitish hairs; soles of hind feet blackish brown; tail pale grayish brown, nearly unicolor.

Type, total length, 317; head and body, 155; tail, 162; hind foot, 36; ear, 17.

Skull, total length, 36; zygomatic breadth, 18.5; interorbital breadth, 5.2; breadth of braincase, 15; length of nasals, 12; diastema, 9; palatal foramina, 5.5; upper toothrow, 5.3. The type is an old female with somewhat worn teeth. There is, however, no sexual difference in size or coloration.

This species is represented by 112 specimens, collected at various localities in the Coast Range, varying in altitude from 4000 to 10,340 feet, as follows:

Cocal, 4000–6000 feet, 5 adults and 5 immature, June 10–17 (Miller).

Gallera, 5700 feet, 2 specimens, immature (Miller).

Munchique, 8225 feet, 45 specimens (26 adult, 19 immature), May 23–June 5 (Miller).

Crest of the Western Andes, west of Popayan, 10,340 feet, 30 specimens (25 adult, 5 immature), July 10–22 (Miller).

Mira Flores, 6200 feet, 6 specimens, April 30–May 1 (Richardson).

San Antonio, 8000 feet, 10 specimens, January 4–12 (Richardson).

Las Lomitas, 5000 feet, 1 specimen, February 26 (Richardson).

Güengü, Cauca Valley, 3500 feet, 1 specimen, May 5 (Miller).

There is a considerable range of individual variation in both size and coloration. In adults with well worn teeth the dorsal surface is less mixed with black-tipped hairs than in young adults which have attained full size as regards external measurements, but which show slight immaturity in the skull; and in old adults the ventral surface is much whiter, through the greater length of the white points to the hairs. The snow white pectoral area, in which the hairs are white to the base, varies considerably in size and form, from a small central spot about 30 mm. long by about 15 mm. broad, to a broad patch 60 mm. or more in length and filling the whole space between the axillæ. Usually there is no trace of a fulvous wash on the underparts but it is present in a few specimens (about 10 per cent.), and varies from the merest trace to deep buff, about three or four specimens in a hundred showing a strong wash of fulvous. It seems to be confined to young adults and not to specimens from any particular locality.

Young specimens, from one-quarter to two-thirds grown, are dusky brown, almost blackish in the younger stages, with a faint trace of yellow tipping the hairs of the dorsal area, while the sides may be strongly washed with yellow, which often forms a well-defined lateral line dividing the dorsal and ventral areas. The white pectoral spot is sharply defined, but the remainder of the ventral surface may be uniform rather dark gray, or gray thinly overlaid with white, formed by the extreme tips of the hairs.

The tail varies from unicolor dark brown or gray brown to indistinctly bicolor either on the basal portion or nearly throughout its length, the upper surface being much darker than the lower, or the light color may be restricted to irregular linear blotches on the lower surface.

The Munchique series contains 20 specimens which the condition of the skull and teeth shows to be fully adult, in only six of which, however, is there distinct wearing of the teeth; but in several of these six the cusps are entirely obliterated.

The average and extremes of the Munchique series are as follows:

20 specimens: Total length, 314 (300–324); head and body, 148 (140–152); tail, 165 (155–176); hind foot, 36 (34–38). Ten skulls: Total length, 35.5 (34.5–37); zygomatic breadth, 17.9 (17–19).

The average and extremes of the series from the crest of the Western Andes, west of Popayan, including only those that the skulls show to be mature (including 7 with *worn* teeth) are as follows:

14 specimens: Total length, 312 (300–330); head and body, 148 (136–160); tail, 164 (154–170); hind foot, 35.4 (33.5–37). Twelve skulls: Total length, 34.7 (34–36); zygomatic breadth, 17.7 (17–19). The seven specimens with greatly worn teeth average somewhat larger than the series as a whole, as follows: Total length, 316 (310–330); head and body, 155 (146–166); tail, 162 (154–170); hind foot, 35.6 (33.5–36); skulls, total length, 35.3 (34–36); zygomatic breadth, 18 (17–19).

This species belongs to the *Oryzomys albigularis* (Tomes) group, but it is much larger than any of the forms of this group hitherto described from western South America. The type locality of *O. albigularis* is Pallatanga, in western central Ecuador, on the west slope of the Andean range. According to measurements of three topotypes given by Thomas[1] it is a much smaller species, the dimensions as given being as follows: Total length, 288 (284–290); head and body, 127 (124–129); tail, 161 (157–165); hind foot, 32 (31.5–33). Specimens of *O. pectoralis* of this size are so obviously immature, in coloration as well as in skull characters, that they could not be mistaken for adults, not would they agree well with the description of *O. albigularis* in coloration. *O. meridensis* Thomas is still smaller, while *O. maculiventer* Allen, from Santa Marta, Colombia, is much larger and very differently colored, the upperparts being strongly reddish brown instead of yellowish brown, as in other forms of the *albigularis* group.

27. **Oryzomys (Oligoryzomys) munchiquensis** sp. nov.

Type, No. 32603, ♀ ad., La Florida (alt. 7700 ft.), July 8, 1911; coll. Leo E. Miller.

Upperparts, from the head posteriorly, pale ochraceous strongly grizzled with black; sides paler without a distinct lateral line; head grayish strongly mixed with black; ventral surface whitish washed with a pale shade of buff; ears well clothed, blackish externally, dull ochraceous internally; upper surface of fore and hind feet uniform pale buffy white, metapodial area not darkened; tail pale brown, slightly lighter below, nearly naked.

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[1] Proc. Zool. Soc. London, 1882, p. 103.

Type, total length, 195; head and body, 81; hind foot (c. u.), 23. Fourteen specimens (only in part exact topotypes), total length, 186 (173–203); head and body, 75.6 (67–86); tail, 110 (99–118); hind foot, 22 (21–23). Skull, total length, 23; zygomatic breadth, 12; interorbital breadth, 2.8; breadth of braincase, 11; length of nasals, 8; diastema, 4.5; palatal foramina, 3.4; upper molar series, 3.

The type is a fully adult female. Represented by 15 specimens, all adult, as follows: La Florida, 3 specimens, July 8 and 9; Cocal, 1 specimen, June 17; crest of Western Andes near Popayan, 1 specimen, July 13; Munchique, 10 specimens, June 1–9, and July 9. These localities are near each other on the western slope of the Western Andes at altitudes ranging from 6000 to 8325 feet, with one specimen from an altitude of 10,340 feet.

This species is a miniature of *O. stolzmanni* Thomas (northern Peru) with the head blackish varied with gray instead of uniform with the rest of the dorsal surface.

28. **Oryzomys (Oligoryzomys) fulvirostris** sp. nov.

Type, No. 32567, ♀ ad., Munchique (alt. 8325 ft.), May 29, 1911; coll. Leo E. Miller.

Upperparts rusty brown profusely lined with black, the hairs being blackish slate for the basal two-thirds, then subapically banded or tipped with yellowish rufous, mixed with hairs wholly black or black-tipped; head less rufous, blackish prevailing in front of the eyes, with a transverse narrow streak of fulvous at the front edge of the whiskers; sides more yellowish than the back, passing insensibly into ochraceous buff on the ventral surface; chin and throat grayish suffused with buff, lighter than the rest of the ventral surface; ears blackish; upper surface of feet flesh color mottled with small blackish scales, conspicuous on the hind feet, not concealed by the sparse light colored bristly hairs; tail grayish brown, nearly naked on the proximal half, increasingly hairy toward the tip with a slight pencil (white in the type, but black in the paratype, and in other specimens received later).

Type, total length, 218; head and body, 188; tail, 130; hind foot, 23.5. Skull, 23; zygomatic breadth, 12; interorbital breadth, 3.2; breadth of braincase, 11; length of nasals, 9; palatal length, 8.2; palatal foramina, 3; maxillary toothrow, 3; diastema, 5.2. Teeth very small; interorbital region rounded on the edges, depressed medially, forming a furrow.

The type is an adult female that had reared young. Represented by three specimens, the type and two adult males, one from Gallera (alt. 5700 ft.), the other (tailless) from the crest of the Western Andes, 40 miles west of Popayan. The paratype is practically indistinguishable from the type in coloration, and varies remarkably little from it in measurements; the total length being 220 instead of 218, the tail 135 instead of 130, and the hind foot 24 instead of 23.5. The tailless specimen had lost its tail before capture, there being no trace of its former presence when the skin was prepared by the collector

This species is a typical *Oligoryzomys* in size and proportions, readily distinguishable by its deep buff underparts and yellowish nose spots, and especially by the conspicuously squamose upper surface of the hind feet.

Worn teeth in the species of *Oligoryzomys* show an enamel pattern similar to that in *Zygodontomys*, and both this group and *Melanomys* might well take the rank of full genera.

29. **Oryzomys (Melanomys) phæopus** *Thomas.*

Twenty-nine specimens: Munchique (alt. of camps, 6000–8325 ft.), May 28–June 9, 7 specimens (Miller); La Florida (7700 ft.), 7 specimens (Miller); Las Lomitas (5000 ft.), Feb. 26, 27, 8 specimens (Richardson); Mira Flores (6200 ft.), April 27–30, 4 specimens (Miller); Caldas (2000 ft.), Nov. 21, 1 specimen (Richardson); Junchito (3400 ft.), May 9, 1 specimen (Miller).

Only one specimen of the La Florida series is fully adult; of the Munchique series six are fully adult and measure as follows: Total length, 220 (204–231); head and body, 121 (114–124); tail, 103 (94–112); hind foot, 27.7 (27–28).

The description of *phæopus*[1] was based on a single specimen from Pallatanga, Ecuador. The present series is evidently referable to this species, since it contains specimens that might have served as the basis of the original description although from localities considerably further north.

In *phæopus* the color of the upper surface is "coarsely grizzled fulvous and black," in *obscurior* grizzled rufous (approaching chestnut) and black, the reddish tone strongly prevailing over the black; in *phæopus* the ventral surface is pale ochraceous buff with a strong mixture of gray, in *obscurior* russet without a superficial wash of gray; in *phæopus* the pelage is coarser and longer than in *obscurior*, the difference being strongly marked and noticeable at a glance; *phæopus* is distinctly larger than *obscurior*; in *phæopus* the tail is brown, somewhat lighter below than above, in *obscurior* unicolor and black. They are found at about the same altitudes, but only one of the forms has thus far been collected at the same localities, though in one instance the localities (Cocal and Munchique) are not far apart.

30. **Oryzomys (Melanomys) obscurior** *Thomas.*

Thirty-six specimens (Miller): Cocal (4000 ft.), June 10–13, 7 specimens, all adult; Gallera (5700 ft.), June 28–July 9, 29 specimens, about one half adult, the others in various stages of immaturity.

The adults of the Gallera series, mostly males, measure: 14 specimens, total length, 209.4 (190–226, with 1 at 234); head and body, 114.6 (107–

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[1] Ann. and Mag. Nat. Hist. (6), Vol. XIV, Nov., 1894, p. 355.

118); tail, 94 (84–109); hind foot, 26.5 (26–28). The skulls range in total length from 28 to 30, and in zygomatic breadth from 14.8 to 15.2.

Cocal series, 7 specimens (4 males, 3 females): total length, 214 (202–228); head and body, 117.5 (113–125); tail, 94 (83–110); hind foot, 26 (24.5–27.5). Skulls, total length, 28.5 (28–29); zygomatic breadth, 15.

Judging from the original description of *Oryzomys phæopus obscurior* Thomas,[1] based on a single specimen with the tail "imperfect at tip," from Concordia, Medellin, Colombia, the present series is referable to that form. My series averages rather larger than the measurements of the single specimen given by Thomas, but there are several adult specimens in the series as small as Thomas's type, which was probably a rather young adult. This is indicated by the fact that the younger adults are not only "much darker throughout [than in *phæopus*], especially on the posterior back, where the fur is practically black, only relieved by a few yellow-tipped hairs," as in the younger adults of my series; in old adults the lower back is not noticeably darker than the anterior half of the dorsal area. In the specimens with the posterior back not different from the anterior, the teeth show more or less wear and the size is at the maximum.

O. phæopus and *O. ph. obscurior* are here both treated as full species, since well marked differences are shown, in my large series representing both forms, in size and coloration, and especially in the texture of the pelage, as already noted under *phæopus*.

Immature specimens, up to half or two thirds grown, of the two forms are, however, not positively distinguishable. In both forms such specimens are uniform dull black above with little or no fulvous or rufous tipping to the hairs, and slaty black below with a slight wash of gray, instead of "ochraceous buff" (Ridgway) with a wash of gray in adult *phæopus*, or "russet" (Ridgway) in adult *obscurior*.

The *Melanopus obscurior* group has a wide range, of which my *M. chrysomelas* of Costa Rica and Nicaragua proves to be only a rather slightly differentiated subspecies.

31. **Oryzomys (Melanomys) obscurior affinis** subsp. nov.

Type, No. 31690, ♂ ad., San José (altitude 200 ft.), Cauca, Colombia, Dec. 3, 1910; coll. W. B. Richardson.

Color of upperparts similar to that in *O.* (*M.*) *obscurior* but decidedly darker with less rufous tipping the hairs; underparts darker, "walnut brown" instead of "russet" (Ridgway); in size and cranial characters not appreciably different from *obscurior*.

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[1] Ann. and Mag. Nat. Hist. (6), Vol. XIV, Nov., 1904, p. 356.

Type, total length, 235; head and body, 145; tail, 90; hind foot, 30; skull, total length, 30.5; zygomatic breadth, 15.8. Ten specimens: total length, 210 (190–235, mostly 210–220); head and body, 120 (110–130, one 145); tail, 86.5 (80–90); hind foot, 27.5 (25–30). Seven skulls: Total length, 29.7 (28.3–31); zygomatic breadth, 15.2 (15–15.8).

The type is an old male with worn teeth, and the largest specimen of the series. Represented by 12 specimens (Richardson): San José (alt. 200 ft.), Nov. 29–Dec. 4, 10 specimens; Los Cisneros (alt. 600 ft.), March 17, 18, 2 specimens.

O. (*M.*) *obscurior* is a dark form, from the humid tropical coast district, of the *Oryzomys obscurior* group.

32. **Æpeomys fuscatus** sp. nov.

Type, No. 32230, ♀ ad., San Antonio (near Cali, alt. 7000 ft.), Cauca, Colombia, Jan. 21, 1911; coll. W. B. Richardson.

Pelage long, thick, soft and velvety. Upperparts blackish, almost clear black over the median dorsal region, with a faint wash of grayish brown over the shoulders and on the sides of the body, almost imperceptible except in favorable lights, when the extreme tips of the hairs are seen to be grayish bistre; underparts dark gray, the pelage being slaty with the extreme tips of the hairs lighter or pale drab-gray; ears brown, thickly clothed with soft black hairs on the basal third externally, the rest nearly naked on both surfaces; feet flesh color, very thinly haired; tail light gray brown, nearly unicolor, naked.

Type, total length, 220; head and body, 110; tail, 110; hind foot, 25; ear (in dry skin), 12. Eleven adults (all topotypes): total length, 203 (190–220); head and body, 108 (100–120); tail, 91.3 (85–110); hind foot, 23 (20–25).

Skull (type), total length, 26.3; zygomatic breadth, 15; interorbital breadth, 5; breadth of braincase, 13; length of nasals, 10.5; palatal length, 11; palatal foramina, 4; maxillary toothrow, 4.2; diastema, 7. Five adult skulls, total length, 26.5 (26–26.8); zygomatic breadth, 14.9 (14.6–15.2).

The type is an old female with the teeth worn; most of the topotypes also have the teeth perceptibly worn; in some of them they are much worn. Represented by 12 specimens, all from the type locality.

This species is evidently related to *Æpeomys vulcani* Thomas, from which it appears to differ in relatively longer tail and somewhat in coloration. *Æ. vulcani* is widely separated from it physiographically, *Æ. fuscatus* being from the west slope of the Western Andes, while the type locality of *vulcani* is Mount Pinchincha at an altitude of 12,000 feet.

33. **Microxus affinis** sp. nov.

Type, No. 32235, ♂ ad., San Antonio (near Cali, alt. 8000 ft.), Cauca, Colombia, Jan. 5, 1911; coll. W. B. Richardson.

Upperparts uniform dusky brown, the extreme tips of the hairs yellowish giving the general effect of olivaceous; below dark grayish brown, the extreme tips of the

hairs olivaceous, giving the general effect of dark grayish brown with a faint olive tinge; ears dull brown, nearly naked, rather short and broad; feet grayish brown, the hairs dark with lighter tips; tail brown, not appreciably lighter below, nearly naked, much shorter than head and body.

Type, total length, 160; head and body, 90; tail, 70; hind foot, 20; ear (in dry skin), 12 × 10. Skull, total length, 25.8; zygomatic breadth, 14; interorbital breadth, 5.2; breadth of braincase, 12; length of nasals, 10; palatal length, 11; palatal foramina, 6 (reaching nearly to middle of m ^{1}); maxillary toothrow, 5; diastema, 5.6.

The type and only specimen is a fully adult male, the teeth slightly worn.

This species appears to be closely related to *Microxus bogotensis* (Thomas), of which it may be a subspecies.

SCIURIDÆ.

34. **Sciurus hoffmanni** *Peters.*

Twenty-six specimens, collected as follows:
San Antonio (7000 ft.), 7 specimens, Jan. 5–Feb. 6 (Richardson).
Mira Flores (6200 ft.), 7 specimens, April 17–28 (Richardson).
Las Lomitas (5000 ft.), 2 specimens, March 12–13 (Richardson).
La Florida (7700 ft.), 1 specimen, July 6 (Miller)
Gallera (5700 ft.), 1 specimen, July 2 (Miller).
Munchique (8325 ft.), 8 specimens, May 26–June 3 (Miller).

Measurements of Specimens from Munchique.

32500,	♂	length,	432;	tail,	232;	hind foot,	55.
32501,	♂	"	434;	"	210;	" "	55.
32502.	♀	"	452;	"	224;	" "	59.
32503,	♀	"	430;	"	247;	" "	55.
32504,	♂	"	454;	"	235;	" "	58.
32505,	♀	"	452;	"	236;	" "	57.
32506,	♂	"	434;	"	218;	" "	55.
32507,	♂	"	459;	"	224;	" "	59.5.

In size, coloration, and cranial characters these specimens, as a series, are indistinguishable from a large series from Costa Rica, the type country of *S. hoffmanni.*

35. **Sciurus gerrardi** *Gray.*

One specimen, Rio San Jorge, Bolivar, Colombia, Dec. 15, 1911 (Mrs. E. L. Kerr).

36. **Sciurus milleri** sp. nov.

Type, No. 32511, ♀ ad., Cocal (altitude 4000 ft.); coll. of Leo F. Miller, for whom the species is named.

In cranial characters similar to *Sciurus hoffmanni*, but much larger and very differently colored.

Premolars $\frac{1}{1}$. Top of head, nape, and posteriorly to middle of back, grizzled rufous and blackish, the hairs being black minutely tipped with rusty; posterior half of mid-dorsal region glossy black without rufous tips to the hairs; the black extends to the basal fourth of the tail, which portion is wholly intense black all around; sides of shoulders and upper surface of fore limbs more rufous than the head and fore-back, the hairs being broadly tipped with orange rufous, which is the prevailing color on the fore limbs and scapular region; sides of the body posterior to the shoulders, the thighs and hind limbs externally strongly rufous, the hairs being conspicuously tipped with rufous; sides of head, chin, and throat dull yellowish gray; inside of fore and hind limbs and ventral surface deep orange rufous, with a tendency to a whitish spot on the breast (absent in the cotype); tail wholly deep black for about the basal third, and the black extends apically to the tip of the tail on the ventral surface, with the sides and upper surface intense red; ears rather small, with fine short dusky hairs externally, and also internally for the apical third; soles blackish.

Type, total length, 508; head and body, 240; tail vertebræ, 268; hind foot, 58. Skull, total length, 55; zygomatic breadth, 32.5; interorbital breadth, 18; length of nasals, 16; upper toothrow, 9.5; diastema, 13.5.

A second specimen (topotype) is a little smaller in external measurements, but the skull has the same length, but in other dimensions varies from 1 mm. larger to .5 mm. smaller. In coloration the same tones of color prevail, except that many of the hairs on the lower back are barely perceptibly rufous-tipped instead of clear black and the tail is washed with orange instead of red. It is also a younger specimen.

This species is apparently related to the *S. variabilis-langsdorffi* group of the upper Amazonian region, with none of the forms of which, however, is it apparently closely related.

37. **Sciurus æstuans caucensis** *Nelson.*

Mira Flores (6200 ft.), 2 specimens, April 29. Near Palmira, Central Andes (6000 ft.), 1 specimen, April 22 (Richardson).

Measurements are available for only two of the specimens, as follows:

32173, ♂, total length, 350; tail, 180; hind foot, 42.
32174, ♀, " " 335; " 175; " " 44.

These specimens are indistinguishable from the hitherto unique type of *caucensis*, from Rio Lima (alt. 5000 ft.).

Mr. Thomas (Ann. and Mag. Nat. Hist. (7), VI, Oct. 1900, p. 366) has suggested that *S. æstuans caucensis* Nelson is probably identical with

Macroxus medellensis Gray, "also from the Valley of the Cauca," but a careful comparison of the type of *caucensis* and the other specimens here referred to *caucensis* with Gray's description of *medellensis* (Ann. and Mag. Nat. Hist., Oct. 1872, p. 408) shows that they are not even nearly related.

38. Sciurus (Microsciurus) similis *Nelson.*

Four specimens: Cocal, June 11 and 15, 2 specimens; Gallera, June 29, 2 specimens (Miller). Altitude 4000 and 5700 feet, respectively. San Antonio, Jan. 29, 1911, 1 specimen (Richardson). Altitude 7000 feet.

Measurements.

32496.	♂,	length.	250;	tail,	121;	hind	foot,	31,	Gallera.
32497,	♂,	"	245;	"	121;	"	"	35,	"
32498,	♀,	"	265;	"	133;	"	"	34	Cocal.
32499,	♀.	"	252;	"	122;	"	"	30,	"
32176,	♂,	"	280,	"	115;	"	"	25,	San Antonio.

These specimens agree perfectly with the type, and previously unique specimen, from near Cali (alt. 6000 ft.).

39. Sciurus (Microsciurus) palmeri *Thomas.*

Two specimens, San José (alt. 200 ft.), Nov. 29 and Dec. 9 (Richardson). San José is only a few miles south of the type locality of the species, and at the same altitude in the tropical coast belt.

MUSTELIDÆ.

40. Putorius macrurus (*Taczanowski*).

Two specimens: Mira Flores (alt. 5200 ft.), adult female, April 1 (Richardson): Munchique (alt. 8325 ft.), adult male, June 1 (Miller). Total length, ♀ 375, ♂ 495; tail, ♀ 150, ♂ 202; hind foot, ♀ 43, ♂ 52. Skull, total length, ♀ 44.5, ♂ 52; zygomatic breadth, ♀ 23.5, ♂ 29.5; mastoid breadth, ♀ 20.5, ♂ 23.

Referred provisionally to this species, with the description and colored plate of which it perfectly agrees. The chin and throat are like the pectoral region — not white as in *P. affinis* (as *affinis* is now commonly accepted).

PROCYONIDÆ.

41. **Nasua olivacea** *Gray.*

Two specimens, an adult male and a young male (with milk dentition), Munchique (alt. 6000 ft.), May 29 and June 6 (Miller). Adult male (very old), total length, 606; tail vertebræ, 128; hind foot, 64.5. Skull, total length, 94; zygomatic breadth, 40.5; mastoid breadth, 35; breadth of rostrum in front of canines, 7.5.

42. **Nasua quichua** *Thomas.*

One specimen, young male (with milk dentition), Popayan, July 23 (Miller).

43. **Bassaricyon medius** *Thomas.*

Two specimens, adult male and female, Gallera (alt. 5000 ft.), west slope of Western Andes, July 13 (Miller).

Total length, very old ♂, 820, ♀ 740; head and body, ♂ 396, ♀ 350; tail vertebræ, ♂ 434, ♀ 390; hind foot, ♂ 71, ♀ 70; total length of skull, ♂ 80; zygomatic breadth, 50. (Skull of female mislaid.)

44. **Potos flavus caucensis** *Allen.*

Three specimens, all old, San Antonio (alt. 7000–8000 ft.), west slope of Western Andes (near Cali), Jan. 8 and 9 (Richardson).

These specimens confirm the characters of the subspecies, based on specimens from upper Cauca Valley (alt. 6000 ft.), near Cali.

FELIDÆ.

45. **Felis jaguarondi** *Fischer.*

One specimen, a flat-skin without skull or feet, Popayan, July 27 (Miller). Clear dark gray with the middle of the back blackish.

SORICIDÆ.

46. **Blarina (Cryptotis) squamipes** sp. nov.

Type, 32378, ♂ ad., crest of Western Andes (alt. 10,340 ft.), 40 miles west of Popayan, Cauca, Colombia, July 17, 1911; coll. Leo E. Miller.

Size very large, color very dark. Above, with head turned from the light, intense black, with head toward the light, with a brownish sheen; below similar but with the brownish sheen much stronger over the pectoral region than on the back; nose and chin lighter, more brownish; upper surface of fore and hind feet dark brown, *heavily scaled*, naked except for a few short black bristly hairs on the hind feet; tail blackish, well clothed with short bristly black hairs.

Type, total length, 128; head and body, 86; tail vertebræ, 42; hind foot, 18; skull (imperfect, lacking the occipital portion), tip of premaxillaries to posterior border of right parietal, 20; length of nasals, 97; palatal length, 9.8; length of entire upper toothrow, 10.5; length of the four large molariform teeth, 6; distance between outer border of last molariform teeth, 6.

The type and only specimen is an old male with the cranial sutures obliterated anterior to the braincase, which part is lacking.

Blarina squamipes is fully equal in size to *B. magna* Merriam from Oaxaca, Mexico, and hence is one of the two largest known species of the subgenus *Cryptotis*. Besides its large size and exceedingly dark color, it may readily be distinguished by the coarse, heavy scales clothing both fore and hind feet — a feature I have not before seen noted in connection with any species of *Blarina*.

PHYLLOSTOMIDÆ.

47. **Artibeus jamaicensis æquatorialis** *Andersen.*

One specimen, adult male, Cali (alt. 2000 ft.), Dec. 22 (Richardson).

48. **Hemiderma perspicillatum** (*Linnæus*).

One specimen, San José, Dec. 4 (Richardson).

THYROPTERIDÆ.

49. **Thyroptera tricolor** *Spix.*

Two specimens, San José, Dec. 11 (Richardson).

CEBIDÆ.

50. **Alouatta seniculus caucensis** *Allen.*

Four specimens (Richardson): Las Lomitas (alt. 5000 ft.), adult female and young male, March 4; Palmira (alt. 3500 ft.), April 15, adult male; Güengüe (alt. 3500 ft.), May 5, adult female.

These specimens agree with the type series of this subspecies in small size, narrow nasals, etc., from the Upper Cauca Valley.

51. **Ateles ater** *F. Cuvier.*

Four specimens, 1 adult male, 2 adult females, and a young female a few weeks old, Gallera (alt. 5000 ft.), July 13 (Miller).

32353, ♂, total length, 1150; tail, 600; hind foot, 155.
32354, ♀, " " 1220; " 630; " " 160
32355. ♀, " " 1260; " 750; " " 160.
32353, ♂, skull, total length, 112; zyg. breadth, 69; breadth of braincase, 57.
32354, ♀, " " " 112; " " 73; " " " 60.
32355, ♀, " " " 115; " " 67; " " " 62.

52. **Aotus lanius** *Dollman.*

One specimen, a hunter's flat skin, without skull, obtained by Mr. F. M. Chapman on the Toche River, Central Andes, Cauca district, in 1911.

53. **Aotus griseimembra** *Elliot.*

Two specimens, adult male and female, Rio Sinu Cereté, Bolivar, Colombia, Nov. 14 and 20 (Mrs. L. E. Kerr).

54. **Seniocebus meticulosus** *Elliot.*[1]

Two specimens, male and female, Rio San Jorge, Bolivar, Colombia, Dec. 11, 1911 (Mrs. E. L. Kerr).

55. **Cebus capucinus nigripectus** *Elliot.*

One specimen, San Antonio (alt. 7000 ft.), adult male, Feb. 21, 1911 (Richardson). Total length, 1020; tail, 510; hind foot, 130. Skull, occipito-nasal length, 97; zygomatic breadth, 69.5; breadth of braincase, 54; length of braincase, 76; length of upper molar series, 22; lower jaw (front base of incisors to posterior border of condyle), 65; angle to top of condyle, 35.5; height at condyle, 37.5; lower molar series, 26.

C. c. nigripectus was based on two subadults and one quite young specimen, all females, from Las Pubas, Upper Cauca Valley.

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[1] *Cf.* antea, p. 31. The type is No. 32703, male.

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Article VIII.— THE RELATIONSHIP OF THE GENUS *PRISCACARA.*

By J. D. Haseman.

The genus *Priscacara* has usually been considered a member of the family of Cichlid fishes. However, its relationship has been questioned in recent years, partly at least because the Cichlidæ are now almost exclusively found in South America and Africa. Hence the exact relationship of *Priscacara* is important from the standpoint of zoögeography. If it is a member of the Cichlidæ, then the point of *family origin* may have been in the northern hemisphere, and not on an ancient southern continent (Gondwana).

Thanks to Professor Bashford Dean, who has placed in my hands the abundant material of the Newbury and Cope Collections in the American Museum, I was enabled to make a study of the relationship of *Priscacara.* I am also indebted to Doctor L. Hussakof for his suggestions in regard to some of the fossil characters.

The genus *Priscacara* was described by Cope in 1877 from Green River, Wyoming (Middle Eocene according to Osborn's 'Age of Mammals'). Cope states that it might be included in the Pomacentridæ but that it differs from the genera now known in the possession of vomerine teeth and in having apparently eight branchiostegal rays. I have been unable to verify the presence of eight branchiostegal rays in the excellent material (which includes Cope's specimens) at the American Museum of Natural History; but to the contrary am certain that the correct number is six. In regard to the vomerine teeth, I think that only two large specimens of *Priscacara serrata* (Nos. 2442 and 2443, American Museum) actually show small sockets which indicate the existence of very small vomerine teeth in this species. The vomer is well preserved in several specimens of other species of *Priscacara,* but no vomerine teeth or sockets were found.

Cope (p. 92) also states that the jaws of *Priscacara* are toothless but Woodward says that the specimens of *Priscacara* have small conical teeth in both jaws. I have verified Woodward's conclusion. Woodward also states that the Cichlidæ have a single narial opening on each side of the snout and that the scales are ctenoid but otherwise they are like the Labridæ. The data given in the following table indicates that this is the correct view: *i. e., Priscacara* is more like the Labridæ than the Pomacentridæ. However both Woodward and Pellegrin have considered *Priscacara* as a member of the Cichlidæ, and I believe that the following data lend strong support to their view.

Pomacentridæ	Labridæ	Cichlidæ	Priscacara
Single nostril on each side	Double nostril on each side	Single nostril on each side	Not certain
A subocular shelf	No subocular shelf	No subocular shelf	No subocular shelf
Lower pharyngeal bones completely united and T or Y shaped	Lower pharyngeal bones completely united and T or Y shaped	Lower pharyngeal bones united but retaining a suture and triangular shaped	Lower pharyngeal bones united but retaining a suture and triangular shaped
Small conical teeth in jaws	Long conical teeth in jaws	Usually short conical teeth in jaws	Small conical teeth in the jaws
Gills 3½ and pseudobranchiae	Gills 3½ and pseudobranchiæ	4 gills and slit behind 4th and no pseudobranchiæ	Not certain
Branchiostegals 5–7	Branchiostegals 5 or 6	Branchiostegals 5 or 6	Branchiostegals 6
No vomerine teeth	No vomerine teeth	No vomerine teeth	Small vomerine teeth in at least 1 species
Preoperculum serrate or entire	Preoperculum serrate or entire	Preoperculum serrate or entire	Preoperculum serrate or faintly so
Vertebræ with transverse processes from 4th to 5th	Vertebræ with transverse processes from the 3rd	Vertebræ with transverse processes from the 3rd	Vertebræ with transverse processes from the 3rd
Ribs attached to the transverse processes when they are present	Ribs attached to the transverse processes when they are present	Ribs sessile or subsessile	Ribs sessile
2 anal spines	3 or more anal spines	3 or more anal spines	3 anal spines
Numerous strong dorsal spines	Numerous slender dorsal spines	Numerous strong dorsal spines (8–23)	10 or 11 strong dorsal spines
Ctenoid scales	Cycloid (or weakly ctenoid) scales	Ctenoid scales	Ctenoid scales
Back part of lateral line wanting	Lateral line continuous or in 2 parts	Lateral line usually in 2 parts rarely continuous	Lateral lines perhaps in 2 parts
Marine	Marine	Freshwater	Very probably freshwater

The Green River Lake Formation is considered an estuarine or land-locked bay deposit (*cf.* page 136, 'Age of Mammals'). This view is apparently derived from the presence of *Dasyatis* and *Notogoneus* whose nearest living relatives are marine forms. On page 572, 'Cambridge Natural History,' Boulenger states that *Notogoneus*, found in fresh water Eocene of France and North America, is related to the marine Gonorhynchidæ which is represented by only one living marine species, *G. greyi*. *Dasyatis*, a member of the order of sharks, is allied to existing forms which frequent the streams and estuaries of Florida as well as adjacent coasts (*cf.* Boulenger, p. 464). Both skates and sharks are known to enter mouths of rivers In fact *Potamotrygon* has many species which are found in rivers of South America. *Diplomystus* also offers no decisive support for a marine origin of the Green River Lake Formation, because some of its surviving relatives are said to exist in rivers and along the coast of Chile and eastern Australia (*cf.* Woodward).

The presence of *Lepidosteus*, *Amia* and other teleosts indicate that the formation is of fresh water origin. The relationship of *Dapedoglossus* (*Phareodus*) and *Priscacara* with forms which live in tropical rivers, also indicates a fresh water origin. *Asineops* (*cf.* Cope, p. 85–87) is considered by Boulenger, p. 656, to be related to *Aphredoderus* which is now found in fresh water. These and other genera indicate that the bulk of the fishes of the Green River Formation were fresh water forms. The deposits also lack typical marine perciform fishes. Hence it appears more probable that the shark-like forms entered this basin from the sea, than that all of the freshwater forms floated down the streams to be deposited near the coast in an estuary or land-locked bay. As far as *Priscacara* is concerned, it makes little or no difference whether the Green River shales were or were not estuarian or land-locked bay in origin, because *Priscacara* is known from undoubted freshwater deposits. Pharyngeal teeth of *Priscacara* are known from the Washakie basin of the Bridger formation (*cf.* Cope, p. 93). Hence *Priscacara* was very probably a freshwater form.[1]

The differences in the sub-ocular shelf, number of anal spines, location of lateral processes on vertebræ, etc., separate the Labridæ and Cichlidæ from the Pomacentridæ. Ctenoid scales, sessile ribs, shape of fused pharyngeal bones with suture, short conical teeth, strong dorsal spines, and being fresh water forms, easily separate *Priscacara* from the Labridæ. The presence of vomerine teeth and a few other characters show a closer relationship between the ancestral Cichlidæ and Percidæ and Centrarchidæ, than is generally accredited, but most of these similarities are apparently ancestral (paleotelic) perciform characters. *Priscacara* is easily separated from these families by its fused lower pharyngeal bones which retain a suture, etc.

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[1] It might be maintained that *Priscacara* entered the freshwater from the sea. This view has some weight in view of the fact that I have shown that *Geophagus braziliensis*, a Cichlid, can live for some time in sea-water. But if such a view were proven, then the origin of the Cichlidæ would be in the sea. This being the case, no favorable evidence would exist from their distribution for a continuous Gondwana Land.

[2] Prof. Grabau also considers the Green River Formation as fresh water (*cf.* Index Fossils, Vol. II, p. 658).

The character of the nares of *Priscacara* cannot be definitely determined. This character is not, I believe, of any great importance because some of the living Cichlidæ (*Geophagus*) have several small pits on their snouts. I have passed bristles through some of these holes and in some cases they were found to be continuous with the cavity beneath the true naris. Besides there appears to be no objection to the view that the ancestral Cichlidæ might have had double nares—possessing, however, the tendency of narial coalescence or disappearance of one of the openings on each side of the head. So *Priscacara* may or may not have had double nares.

In all details, which can be definitely determined, excepting the presence of vomerine teeth in at least one species of *Priscacara,* this genus agrees with the Cichlidæ. The presence of degenerate or small vomerine teeth in any or all of the species of *Priscacara* is not, I believe, of sufficient importance to separate the genus from the Cichlidæ, because many of the primitive perciform fishes had vomerine and palatine teeth. It is, therefore, quite probable that the ancestral Cichlidæ also had degenerating vomerine teeth. In fact, the small size of the vomerine teeth in *Priscacara* may be evidence of the trend of their evolution. The teeth may be adolescent in the smaller species of *Priscacara,* where, in spite of favorable material, they could not be determined. On the other hand it is possible that the development of some of the living Cichlidæ would show traces of vomerine teeth if the different genera were studied. Therefore it appears that the data at our command are sufficient to show that *Priscacara* is an ancestral Cichlid.

Notes.

The serrate preoperclum of *Priscacara* vaguely indicates, along with other characters, that the American genus *Crenicara* is more primitive than the genus *Aequidens* which is usually considered to be the most primitive.

Priscacara sp.? Specimen No. 2583 in the American Museum has fused lower pharyngeal bones with a suture.

Priscacara oxyprion Cope, No. 2447 Amer. Mus., has a lateral line which apparently ends under the posterior base of the soft dorsal. The same specimen has two or three lateral line scales on the base of the caudal. This may indicate a two-part lateral line, if not, it being continuous, makes no difference, for some of the living Cichlidæ have continuous lateral lines (*cf. Cichla*).

Priscacara serrata Cope, Nos. 2442 and 2443 Amer. Mus., evidently have sockets of teeth on the end of the vomer.

The specimens all have twenty-four or more vertebræ (usually twenty-six), but this is a very variable character in perciform fishes. The serrate preoperculum is also found in living Cichlidæ (*cf. Crenicara*). The arrangement of scales on the cheeks, pre- and sub-operculum, also vary much in living Cichlidæ.

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59.9,32 O (78.8)

Article IX.—A NEW PIKA FROM COLORADO.

By J. A. Allen.

The Museum has recently received as a gift from Mr. J. D. Figgins, Director of the Colorado Museum of Natural History, a series of nine specimens of *Ochotona*, three of which are from Pagoda Peak, Routt County, Colorado, and six from Geneva Park, between Mount Evans and the main divide, about 70 miles west of Denver. Three of the Geneva Park specimens are in summer pelage (August 28–31) and three in winter pelage (November and December). The Pagoda Peak specimens were taken October 30, and are also in winter pelage and thus comparable with the November-December Geneva Park series. The skulls of the two series show no appreciable differences, but the series are quite different in coloration. The Geneva Park specimens are of course referable to *Ochotona saxatilis* Bangs; the others, representing an isolated colony at Pagoda Peak, northwestern Colorado, may be distinguished as

Ochotona figginsi sp. nov.

Type, No. 32721, ♀ ad., Pagoda Peak, Routt County, Colorado, Oct. 30, 1910; collected and presented by Mr. J. D. Figgins, for whom the species is named.

Not appreciably different in size and cranial characters from *Ochotona saxatilis*, but different in coloration; the ground color of the pelage of the upper parts is much darker, the subapical light band of the hairs being very pale yellowish white in *saxatilis* and very near ecru drab in *figginsi*; the black tips of the hairs are also fewer and much shorter in the former, not forming a very pronounced feature, while in *figginsi* they are so abundant and so much longer as to give a blackish tone to the coloration; in *saxatilis* the ventral surface, in winter pelage,[1] is pale buff, with the pectoral band approaching ochraceous buff; in *figginsi* it is white with a pale yellowish wash, a little stronger and more buffy on the pectoral band, but not of the deep buff seen in *saxatilis*. The lower borders of the dorsal area in *figginsi* share in the darker general tone of the upperparts, and are thus much deeper and more of a cinnamon than in *saxatilis*.

My attention was called to the Pagoda Peak animal by Mr. Figgins, who in collecting the specimens here described found that they had "quite a different note from those found about the main Divide [*i. e.*, *O. saxatalis*] and differed somewhat in color, possibly subject to separation." He adds: "Perhaps nothing will describe this difference [in the notes] more fully than to say that those on the Divide have a sharp, clear note, while those of the Routt County region have a lower and more guttural note, giving one the impression that they were suffering from a bad cold in the throat.... In case the differences prove sufficient to warrant separation, I will deem it a favor if you will describe it."

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[1] *Ochotona saxatilis* Bangs was based on a series of specimens in summer pelage, from Montgomery, near Mount Lincoln, Park County, Colorado, collected by me July 27, 1871. (See Monographs of North Amer. Rodentia, 1877, p. 411.) In this species, as probably in all other species of the genus, the summer and winter pelages are very unlike.

Respecting the locality he states (*in litt.*): "In the northwest corner of the State [Colorado], there are numerous detached peaks or cones several thousand feet above the plateau,[1] and upon one or two of these, possibly more, conys are found....As far as the natural habitat of these animals is concerned. the lava cones are as isolated as if they were islands."

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[1] Gannett gives the altitude of Pagoda Peak (on the authority of Hayden), as 11,251 feet.

56.81, 9 T:14.71, 79

Article X.— THE OSTEOLOGY OF THE MANUS IN THE FAMILY TRACHODONTIDÆ.

By Barnum Brown.

The general osteological characters of this family were briefly stated in the description of *Claosaurus* (= *Trachodon*) *annectens* by Marsh, American Journal of Science, 3d series, vol. 44, 1892, pages 171–173, accompanied by a restoration of the skeleton. In his description of the skeleton, which was copied later in 'The Dinosaurs of North America,' 16th Annual Report of the U. S. Geological Reports, 1896, Marsh says:

"The humerus is comparatively short, and has a prominent radial crest. The radius and ulna are much elongated, the latter being longer than the humerus, and the radius about the same length. The ulna has a prominent olecranon process, and is a stouter bone than the radius. The carpal bones were quite short, and appear to have been only imperfectly ossified. The fore foot, or manus, was very long and contained three functional digits only. The first digit was rudimentary, the second and third were nearly equal in length, the fourth was shorter and less developed, and the fifth entirely wanting, as shown in Plate II, figure 1.

"In the functional digits (II, III and IV) the phalanges are elongate thus materially lengthening the fore foot. The terminal phalanges of these digits are broad and flat, showing that they were covered with hoofs and not with claws. The limb as a whole was thus adapted to locomotion or support, and not at all for prehension, although this might have been expected from its small size and position.

"The elongation of the fore arm and manus is a peculiar feature, especially when taken in connection with the ungulate phalanges. It may, perhaps, be explained by supposing that the animal gradually assumed a more erect position until it became essentially a biped, while the fore limbs retained in a measure their primitive function, and did not become prehensile, which was the case in some allied forms."

This description was based on a practically complete skeleton found by Mr. J. B. Hatcher in the Lance formation of Converse County, Wyoming. Although the bones were all associated at the time of discovery it seems quite evident that in extracting it from the matrix or in subsequent handling the bones of the manus were changed. This fact is clearly established by a nearly complete skeleton of the same species from the same formation and general locality recently purchased from Mr. Chas. Sternberg and now exhibited in the American Museum, No. 5060. In Marsh's restoration four digits are shown, three bearing hoofs which were considered to be the II, III and IV. I is shown as rudimentary with two phalanges and without terminal hoof. Two complete lines of ossified carpals are introduced, and the phalangeal formula, according to this restoration, is as follows:

Digit I, two phalanges without hoof.

Digit II, three phalanges, the third a hoof.

Digit III, three phalanges, the third a hoof.

Digit IV, three phalanges, the third a hoof.

This reconstruction was followed in mounting the skeleton erected in the Yale University Museum, also in a skeleton of the same species mounted in the National Museum, Washington, also in the two skeletons of *Trachodon mirabilis* in the American Museum of Natural History.

The manus in each of these mounted skeletons is incorrectly assembled as shown in this new skeleton (Fig. 1), the skin characters of which are now being published by Professor H. F. Osborn. In this specimen there are only two ossified carpals present, one above the other, apparently in normal position as they are found in the same position in each foot. This specimen shows conclusively that digit I is absent. The phalangeal formula (Fig. 2, p. 108) is as follows:

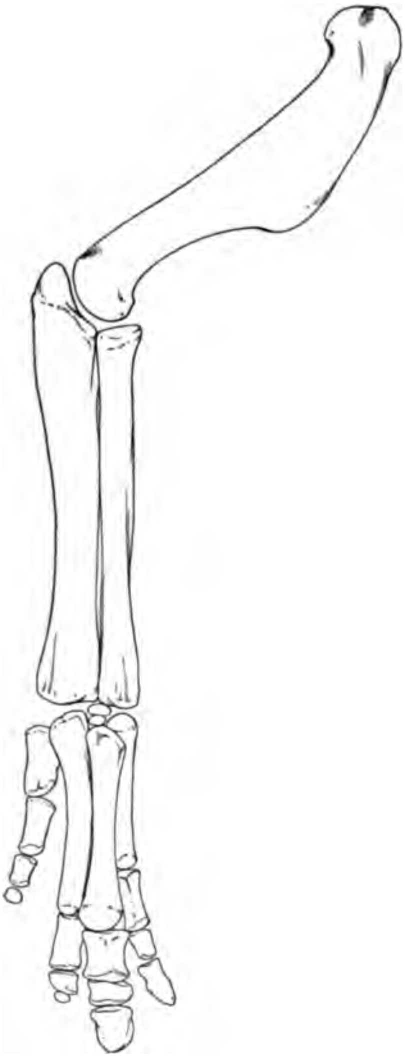

Fig. 1. Manus of *Trachodon* correctly assembled. Position of phalanges determined from skeleton No. 5060.

Digit II with three phalanges, the third a hoof.
" III " " " " " " "
" IV " " ' no hoof.
" V " " " " "

The metacarpals are distinct in form and cannot be confused. Mtc. V is very short, massive and divergent. The other three are closely appressed throughout their length and are not divergent.

Mtc. IV is curved transversely and its proximal end is greatly enlarged. The distal end is quite small and round.

Mtc. III is equal in length to Mtc. IV. It is enlarged at each end with the distal end considerably larger than the proximal end. In position it extends below II and IV a distance equal to the thickness of the lower carpal bone.

Mtc. II is considerably shorter than III and IV, and is nearly uniform in diameter throughout its length with the ends slightly enlarged.

The phalangeal formula is remarkable considering the development of the digits. The proximal row is longest and that of digit III is largest of the series. Those of the second row are irregular in form; in digits III and IV they are slightly triangular. Of the terminal row II and III are well formed hoofs, while IV and V have deteriorated into small rounded bony nodules.

In none of the phalanges are the articular ends developed to the degree of articulating perfection seen in the pes.

The extreme elongation of the metacarpals, the loose articulation of the phalanges, and the reduction of the unguals to two functional hoofs indicate that the manus was no longer used to any extent in progression.

In the European *Iguanodon* and its American representative *Champtosaurus* the manus still functioned to considerable extent in progression.

The integument in this specimen extends over all the phalanges but the terminal hoofs of digits II and III are as well formed as those in the pes and were undoubtedly covered by a nail. In life the integument was probably continuous over all the phalanges with exception of the terminal hoofs of digits II and III.

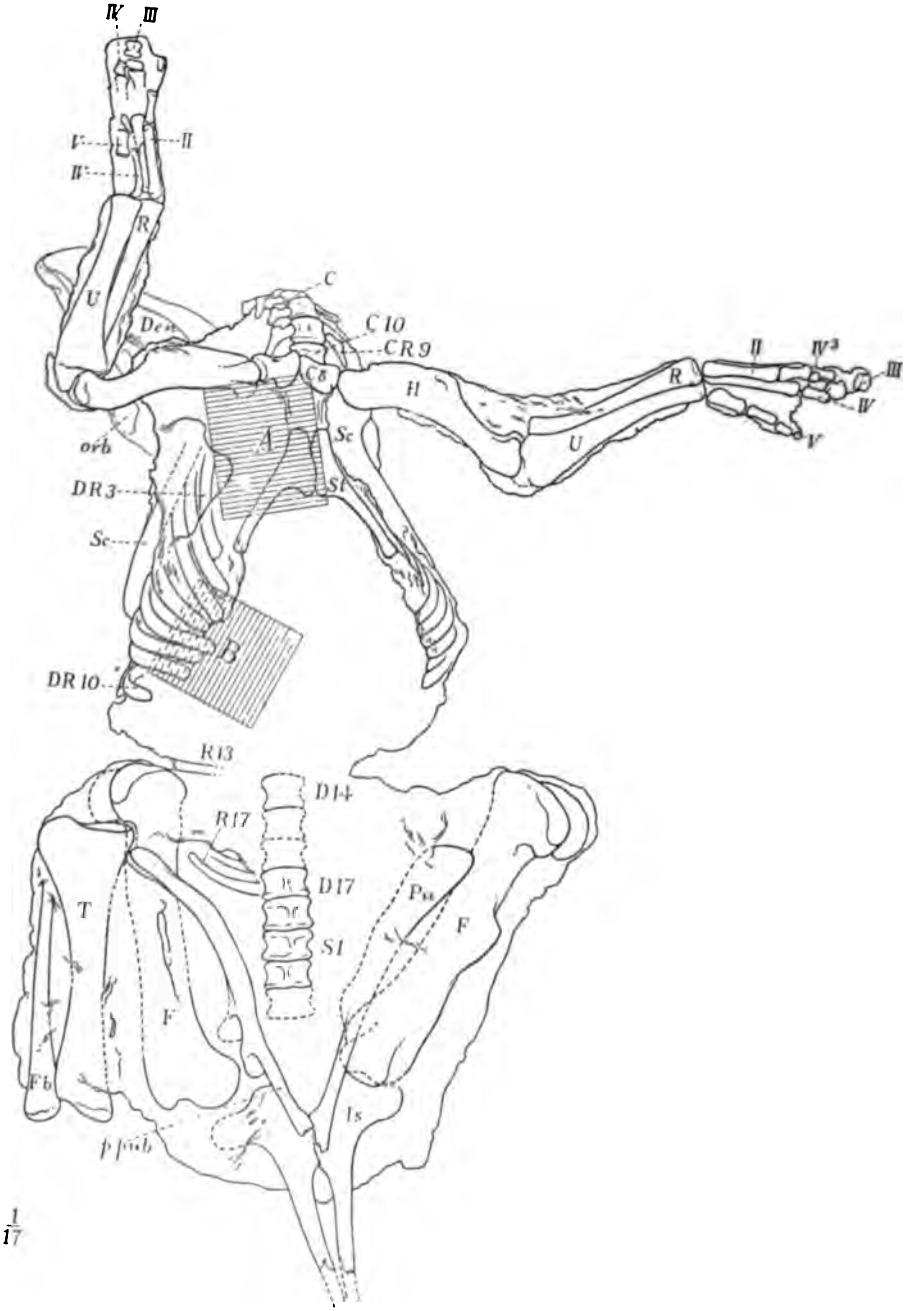

Fig. 2. Ventral view of skeleton No. 5060, *Trachodon annectens.* Phalanges partly embedded in skin.

59.7(729)

Article XI.— NOTES ON WEST INDIAN FISHES.

By John Treadwell Nichols.

I.— *Antennarius astroscopus*, a new Frog-fish from Barbadoes.

The Museum has recently received a specimen (Am. Mus. No. 3315) of the genus *Antennarius* from Barbadoes, a gift from Dr. A. B. Deynard, which belongs to a hitherto undescribed species.

The specimen is about six inches in total length, deep and compressed. Depth 1.5 to base of caudal. Maxillary vertical, 3.5 in length of head. Dorsal II–I–12. Anal 7. Pectoral 10. Skin very rough with small prickles which are mostly bifed. Eye contained twice in snout, orbit larger. First dorsal spine is a movable bulbous knob from the posterior side of which rises an extremely slender spine, broken in our specimen. The second spine is free and about one-half as long as the third, which is joined to the back by skin. Dorsal high and continuous, its anterior rays not different from the posterior. Color, in spirits, pale with blotches of reddish, perhaps due to artificial staining. Dorsal with a black ring on the center of its posterior rays. Anal with a large, oblong, black ring or ocellus. Caudal with two rings on its upper two thirds, directly over one another. A ring on side. A small ring at base of third dorsal spine. A black spot on the posterior bend (elbow) of the pectoral. A few black spots on the sides and streaks on the fins.

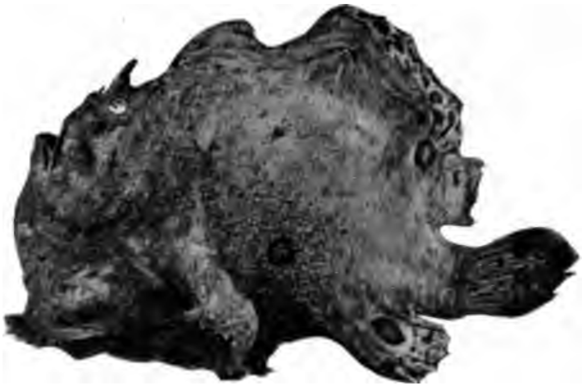

Fig. 1. *Antennarius astroscopus*, n. sp.

This fish is close to *Antennarius stellifer* Barbour [1] but differs from it in form and color, in having a different soft dorsal, and different squamation about the second dorsal spine.

II.— *Pseudomonacanthus amphioxys* (COPE) FROM DOMINCA AND BERMUDA.

The Museum has recently received a specimen of *Pseudomonacanthus amphioxys* 140 mm. long, collected by Mr. Roy W. Miner of the Department of Invertebrate Zoölogy, at Dominica, West Indies. As the species is not well known, an outline sketch of it, compared with our two common *Monacanthus*, will be of interest. There is also in the collection of the Museum a specimen from Bermuda, 162 mm. long, which closely resembles this Dominican fish, but has the pelvic bone decidedly more horizontal, the depth of the fish consequently less. That of the Bermuda fish is 1.8 in length to base of caudal, that of the Dominican fish 1.6. Whereas this variation is perhaps due to specific distinctness, it seems best in view of the scanty material for comparison at present, to consider both specimens *P. amphioxys*.

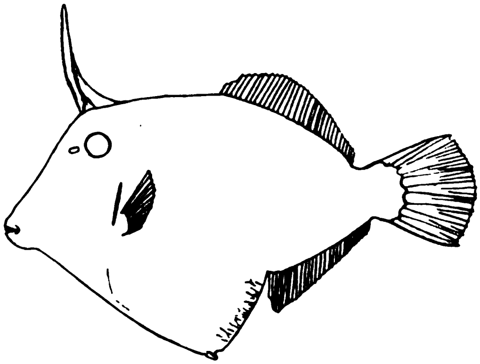

Fig. 2 *Pseudomonacanthus amphioxys* (Cope).

They differ from our two species of *Monacanthus* notably in the less movable pelvic bone, and fixed ventral spine. The dorsal spine is granular in front, without strong spinules behind. It fits into a pronounced groove in the back, which is quite absent in our *Monacanthus*.

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[1] Barbour, Bull. Mus. Comp. Zoöl., Cambridge, Mass., XLVI, 1905, p. 132.

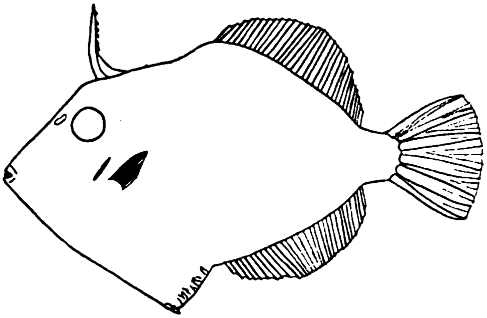

Fig. 3. *Monacanthus hispidus* (Linnæus).

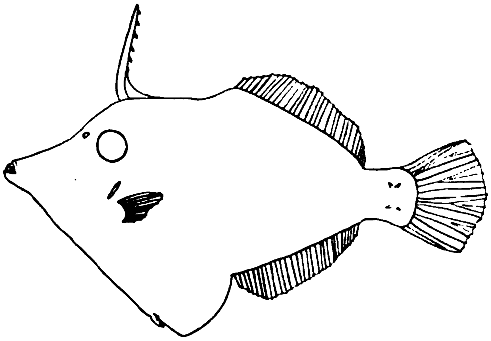

Fig. 4. *Monacanthus ciliatus* (Mitchill).

59.9,725: 14.71, 77

Article XII.— NOTES ON THE TRAPEZIUM IN THE EQUIDÆ.

By S. H. Chubb.

The trapezium, a bone generally believed to be of very rare occurrence in the domestic horse, seems much more frequently present than has been supposed and careful dissection will no doubt show that it is well worthy of being included in the horse skeleton although it has no important function at the present time. It is rather surprising that it should still exist when the first digit, with which it functioned, must have ceased to be of service early in or before the Eocene epoch.

The writer obtained a miscellaneous collection of 35 sets of carpal bones from adult horses. These also included in most cases the proximal end of the metacarpus. The specimens procured in the flesh were carefully dissected and cleaned with the result that in 57% the trapezium was found perfectly well-defined though varying considerably in size and shape, the larger ones being roughly triangular and about 17 mm. in their greatest diameter. The smallest in the collection is 5 mm. Many of the larger ones have well-defined facets articulating with the trapezoid and also with the 2nd metacarpal (inner splint bone) while the majority articulate only with the trapezoid. Several of the smaller specimens have no articulation whatever, but were simply lodged among the ligaments. With the exception of some of the larger bones there is no uniformity of character but simply an irregularly shaped nugget of bone, so that it would be impossible to identify one if found out of place. Fig. 1 shows one of the more developed specimens and also an average example.

A most unexpected find in the preparation of these specimens was a vestigial 5th metacarpal (Fig. 2). This bone is 16 mm. in length and 7 mm. in diameter and articulated with the 4th metacarpal (outer splint bone). In shape and general appearance it is wonderfully similar to the 5th metacarapal of one of the Middle Oligocene horses *Mesohippus*, also shown in Fig. 2. (No. 9777 American Museum collection.)

Trapezium of the Asses and Zebras.— Judging from the more definite character and comparative uniformity of the trapezia examined in the several species of asses, I should rather expect to find it constant in these species, although it would be unwise to speak positively on this point in view of the small number of subjects examined.

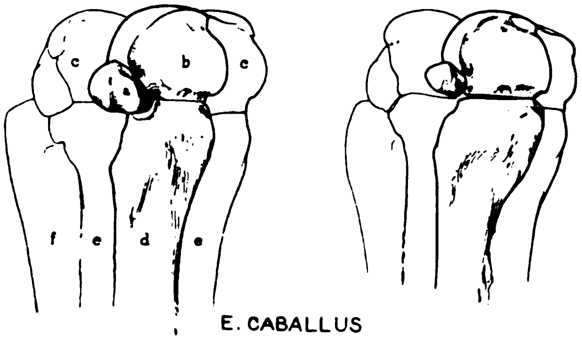

Fig. 1. Distal row of carpal bones and proximal end of metacarpus showing trapezium in place. ½ nat. size.
a, trapezium; *b*, trapezoid; *c*, magnum; *d*, 2nd metacarpal; *e*, 3rd metacarpal; *f*, 4th metacarpal.

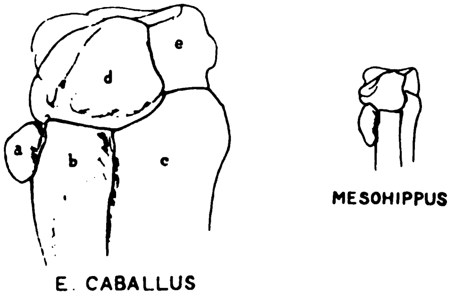

Fig. 2. Lateral view of metacarpus showing 5th metacarpal; ½ nat. size. *a*, vestigial 5th metacarpal; *b*, 4th metacarpal; *c*, 3rd metacarpal; *d*, unciform; *e*, magnum.

The Kiang (*Equus hemionus*).— In this specimen, the wild ass of northern Asia (Fig. 3), the trapezia are perfectly paired and have none of the abortive appearance characteristic in the horses and have no articulation with the 2nd metacarpal.

The Domestic Ass (*Equus asinus*).— In the domestic ass (Fig. 3) they are as nicely formed as in the kiang and are placed low on the trapezoid, having a well developed facet for articulation with the 2nd metacarpal.

In the zebras the few specimens at hand would seem rather to point to the same or a greater irregularity than in the horses.

In Grevy's zebra (*E. grevyi*) the trapezia are placed much higher on the trapezoids than in the asses, widely separating them from the 2nd metacarpal below. The left one is imperfectly formed and much smaller than the right.

E. granti, the last specimen figured, gives further evidence of irregularity.

The right trapezium is very small and simple in form, while on the left side it is entirely absent.

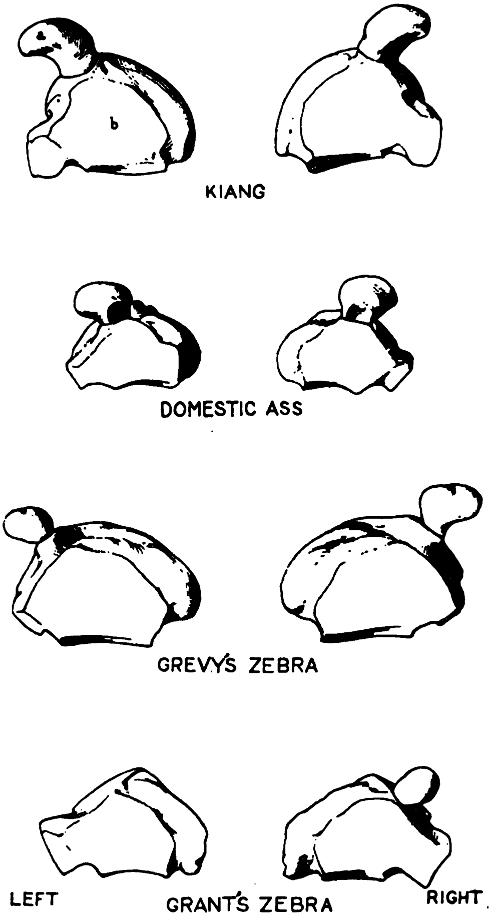

Fig. 3. Trapezia and trapezoids of asses and zebras. Inferior surface. Natural size. *a*, **trapezium;** *b*, **trapezoid.**

After more extensive examination the trapezium may prove to be very irregular in the zebras, but in *E. caballus* at least it seems quite permissible to include it when considering the skeleton.

59.9(72.2)

Article XIII.—MAMMALS COLLECTED BY THE 'ALBATROSS' EXPEDITION IN LOWER CALIFORNIA IN 1911, WITH DESCRIPTIONS OF NEW SPECIES.[1]

By Charles Haskins Townsend.

[By permission of the U. S. Commissioner of Fisheries.

Plates VIII and IX.

The mammals brought back by the 'Albatross' Expedition number 259 specimens, representing 59 species, ten of which, from islands in the Gulf of California, appear to be undescribed.

Mammals, usually of the smaller kinds, were obtained at nearly all of the twenty-seven localities visited by the ship. While a single night's trapping often yielded numerous specimens, many were destroyed by ants before the traps could be visited in the morning. Wood rats, pocket mice and deer mice were especially numerous, and it was possible to obtain them by setting traps almost anywhere in the bushes near the beaches.

Deer and coyotes were obtained at two, hares at six, spermophiles at three, and kangaroo rats at four localities. Specimens of lynx, fox, raccoon, skunk, and gopher were secured only in the Sierra Laguna mountains by a collector sent from the ship. The elephant seal was found only at Guadalupe Island. As the work of the cruise included deep sea investigations, sometimes at considerable distances from land, all anchorages were of short duration and at points rather widely separated.

The greater part of the collection of mammals was prepared by Mr. H. E. Anthony, now of the Museum staff.

The islands visited include Guadalupe, the San Benitas, Cedros, Magdalena, Margarita, and San Roque in the Pacific, and Ceralbo, Espiritu Santo, San José, Santa Cruz, Santa Catalina, Carmen, Angel Guardia, San Esteban, and Tiburon in the Gulf. In physical characteristics, the islands bear close resemblance to the coastal regions of the Peninsula, having the same desert-like appearance. Some of them are totally without fresh water, and most of them are uninhabited. Small mammals were obtained only at islands where the traps could be left out over night.

The following notes relate to islands from which new species were procured.

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[1] Scientific Results of the Expedition to the Gulf of California in Charge of C. H. Townsend, by the U. S. Fisheries Steamship 'Albatross' in 1911. Commander G. H. Burrage, U. S. N., Commanding.

Tiburon is the largest island in the Gulf; it is thirty miles long by about fifteen in width, and has a height of 4000 feet. It is separated from the Mexican mainland by a channel from one to three miles wide, and is inhabited by Seri Indians reputed to be dangerous to small parties.

Angel de la Guardia is near the western shore of the Gulf. It is forty miles long by about ten miles wide, and has a height of about 4000 feet; it is without fresh water and is uninhabited.

San Esteban is exceedingly rough and mountainous with a height of 1800 feet and a diameter of about four miles. It lies eight miles southwest of Tiburon, is without fresh water and is uninhabited.

Carmen, near the Peninsula, is seventeen miles long by five and a half miles wide, and has a height of 1500 feet. Important salt-works are located here.

List of Species.

DELPHINIDÆ. PORPOISES, DOLPHINS, ETC.

Porpoises were observed almost daily while the 'Albatross' was in the Gulf of California. They were especially numerous about the head of Concepcion Bay, where a band of two hundred or more came near the anchorage and showed little fear of the launch which several times passed among them.

1. **Tursiops nuuanu** *Andrews.* NUUANU DOLPHIN.

Two skulls, Santa Catalina Island, April 16.

The skulls obtained by the 'Albatross' Expedition at Santa Catalina Island, when compared with a skull obtained by Mr. J. T. Nichols, in the Pacific (Lat. 12° N., Long. 120° W.), were found to be identical. The species was then described by Mr. R. C. Andrews in Bull. Am. Mus. Nat. Hist., Vol. XXX, Art. IX, pp. 233–237, August 26, 1911.

2. **Tursiops gilli** *Dall.* GILL'S DOLPHIN.

Skull, San Bartolome Bay, March 14.

Porpoises were seen daily while the 'Albatross' remained in San Bartolome Bay. The skull obtained was found on the beach with portions of the skeleton.

3. **Globicephalus scammoni** *Cope.* SCAMMON'S BLACK-FISH.

Twelve skulls, Santa Cruz Island, April 16.

There were many skulls and skeletons of this species on the beaches at

Santa Cruz Island, and also at Santa Catalina, where we called the same day. There was evidence that all the animals had been killed for their oil.

BOVIDÆ. SHEEP, BISON, ETC.

We were informed by a resident that the mountain sheep is found among the high, rugged hills on both sides of Concepcion Bay, but it is more numerous on the ranges further inland. Only one was seen by our party.

Our informant, Sr. Liberato Castro, from whom the horns were received, said that we would find good sheep hunting on Tiburon Island, but no traces of the species were found during our hunting there on April 12–13. The name used at Concepcion Bay for the mountain sheep is "borrego cimmaron." The species is found throughout the desert ranges of the eastern side of the Peninsula, from west of the mouth of the Rio Colorado southward to near La Paz.

4. **Ovis cervina cremnobates.** *Elliot.* LOWER CALIFORNIA MOUNTAIN SHEEP.

Four pairs of horns, south end of Concepcion Bay, April 7.

ANTILOCAPRIDÆ. PRONG-HORN ANTELOPE.

5. **Antilocapra americana mexicana** *Merriam.* LOWER CALIFORNIA ANTELOPE.

One head, inland from Santa Rosalia Bay.

The antelope was formerly found on many of the plains of Lower California, but is now rare. It is not at present known to exist further south than the Santa Clara Desert, about midway on the Peninsula.

CERVIDÆ. DEER.

6. **Odocoileus hemionus peninsulæ** *Lydekker.* LOWER CALIFORNIA DEER.

Male juv., San Bartolome Bay, March 14; female, San Bernado Mountains, May 13; male, San Bernado Mountains, May 15, 600 ft.; male, San Bernado Mountains, May 16, 600 ft.

On the Peninsula deer were seen at only a few localities, but are said to be rather common.

7. **Odocoileus hemionus eremicus** *Mearns.* TIBURON ISLAND DEER.

Male and female ad., Tiburon Island; male, antlers only, all from Tiburon Island, April 12.

Deer are abundant at Tiburon Island if one may judge by their tracks and trails. Several of the animals were seen and two specimens were obtained. The weight of a heavily antlered buck, killed by Lieut. Stanley, was 121 pounds after evisceration.

8. **Odocoileus cerrosensis** *Merriam.* CEDROS ISLAND DEER.

Fragments of weathered antlers, Cedros Island. Probably now extinct; killed formerly by miners for food.

LEPORIDÆ. HARES, RABBITS.

The collection of jack rabbits although small contains two especially striking forms, the grayish or silvery rabbit of Tiburon Island, allied to species of the Mexican mainland, and the remarkably dark species peculiar to Espiritu Santo Island. The latter with its glossy black back resembles no other rabbit, and is a most striking variation from the form inhabiting the adjacent coast of the Peninsula.

9. **Lepus californicus magdalenæ** *Nelson.* MAGDALENA ISLAND JACK RABBIT.

Male, Santa Margarita Island, March 20.

10. **Lepus californicus xanti** *Thomas.* CAPE SAN LUCAS JACK RABBIT.

Male, Cape San Lucas, March 24; female, Pichilinque Bay, March 28.

11. **Lepus insularis** *Bryant.* ESPIRITU SANTO JACK RABBIT.

Female, Pichilinque Island, March 27,— introduced from Espiritu Santo Island; female, Espiritu Santo Island, April 18.

12. **Lepus alleni tiburonensis** subsp. nov. TIBURON ISLAND JACK RABBIT.

Closely related to *L. alleni*, from which it differs in being much darker and more iron gray, the buffiness on the back being rather pale and much overlaid and mixed with black.

Sides of body and outside of legs much darker and more iron gray than in *alleni*. Rump patch darker and less differentiated from color of back. Iron gray of sides extending on underparts, leaving only a narrow median white area. Under side of neck more buff, ears darker and grayer. Top of head very similar to *alleni*.

Type, No. 31990, male. Represented by three males in rather worn spring pelage, Tiburon Island, April 13.

A dozen or more of these rabbits were seen by our party. Measurements, average of three specimens: total length, 610; tail, 63, hind foot 127.

Heteromyidæ. Pocket Mice, Kangaroo Rats, etc.

Pocket mice of the genus *Perognathus* are naturally abundant in the desert-like country of Lower California, and were obtained at all localities where the traps were set at night.

There were signs that they were quite as common on the islands as on the Peninsula. They are burrowers, nocturnal in habit, and feed on seeds which they collect and carry in their cheek pouches.

13. **Perognathus penicillatus arenarius** *Merriam*. Little Desert Pocket Mouse.

Male, San Bartolome Bay, March 14; male San Francisquito Bay, April 10.

14. **Perognathus spinatus peninsulæ** *Merriam*. Cape San Lucas Pocket Mouse.

Seven males, 3 females, Cape San Lucas, March 24; 5 males, San José del Cabo, March 26; 2 males and 2 females, Pichilinque Bay, March 28–30; male, Agua Verde Bay, April 2; male and female, Mulege, April 5; male, Concepcion Bay, April 8; 3 males, Miraflores, April 25; female, San Bernado Mountains, May 5.

15. **Perognathus penicillatus siccus** *Osgood*.

Male, 2 females, Cape San Lucas, March 24.

16. **Perognathus baileyi rhydinorhis** *Elliot*. San Quentin Pocket Mouse.

Two males and 3 females, Pichilinque Bay, March 29–30; male, Concepcion Bay, April 8.

17. **Perognathus fallax** *Merriam*. SHORT-EARED CALIFORNIA POCKET MOUSE.

Female, San Bartolome Bay, March 14.

18. **Perognathus spinatus bryanti** *Merriam*. BRYANT POCKET MOUSE.

Four males, female, San José Island, April 1; 3 males, Espiritu Santo Island, April 19.

19. **Perognathus baileyi insularis** subsp. nov. TIBURON ISLAND POCKET MOUSE.

In size and color about the same as *P. penicillatus pricei*. Skull in general rather narrower; rostrum and nasals narrower; interparietal larger. Ascending branches of supraoccipital narrower; maxillary arm of zygoma weaker.

Type, No. 31846, male.

Represented by 2 males and 1 female, Tiburon Island, April 13.

Measurements, average of three specimens: total length, 212; tail, 119; hind foot, 27.3.

20. **Perognathus penicillatus goldmani** subsp. nov. GOLDMAN'S POCKET MOUSE.

In general size and color about the same as *P. baileyi*; skull slightly smaller and lighter; molariform toothrow shorter; inner side of parietal shorter. Named for Edward A. Goldman.

Type, No. 31845, male, Tiburon Island, April 13.

Measurements of the type: total length, 171; tail, 90; hind foot, 23.

21. **Perognathus spinatus nelsoni** subsp. nov. CARMEN ISLAND POCKET MOUSE.

Compared with *P. spinatus peninsulæ*, the color is grayer and lacks the drab brown effect seen in *peninsulæ*; general size similar, but tail slightly shorter — decidedly shorter than in *bryanti*.

Type, No. 31855, male.

Represented by 2 males and 1 female, Carmen Island, April 3. Named for Edward W. Nelson, well known for his studies of Lower California mammals. Measurements, average of three specimens: total length, 172; tail, 93; hind foot, 24.

Kangaroo rats are very abundant on Tiburon Island where there were many tracts of level ground conspicuously marked with their burrows and well-beaten trails. Being nocturnal, we saw nothing of them, but the traps yielded specimens both nights we were at the island. They did not appear to be so common at other places visited by the 'Albatross'.

KANGAROO RATS.

Kangaroo rats are handsome animals with velvety fur, and derive their name from the long hind legs and tail and the habit of leaping kangaroo fashion. They have cheek pouches in which food is carried to their burrows.

22. **Dipodomys insularis** *Merriam.* SAN JOSÉ ISLAND KANGAROO RAT.

Male, 2 females, San José Island, April 1.

23. **Dipodomys merriami** *Mearns.* TIBURON ISLAND KANGAROO RAT.

Seven males and 1 female, Tiburon Island, April 12–13.

24. **Dipodomys merriami simiolus** *Rhoads.* ALLIED KANGAROO RAT.

Male, 3 females, San Francisquito Bay, April 10.

25. **Dipodomys merriami melanurus** *Merriam.* BLACK-TAILED KANGAROO RAT.

Six specimens, Miraflores, April 25–May 2.

GEOMYIDÆ. POCKET GOPHERS.

These animals are active burrowers, living almost entirely under ground. They are vegetable feeders and have cheek pouches in which to carry food.

26. **Thomomys bottæ anitæ** *Allen.* SANTA ANITA POCKET GOPHER.

Seven specimens, Miraflores, April 28–May 4.

MURIDÆ. WOOD RATS, DEER MICE, ETC.

Wood rats were obtained by night trapping at most of the localities visited by the 'Albatross'. It is, by reason of its conspicuous brush nest, more in evidence than any other mammal. Nests were seen by the dozen in all sorts of locations, from the high, rocky ridges, down to the mangrove belts along the lagoons. One nest high up on Margarita Island, was built quite in the open against the side of a rock commanding an extensive view. The broken twigs of which it was largely composed, were covered entirely over with pieces of cactus, the dried dung of burros and cattle and a bushel of small stones. Another, just back of the beach and in the center of a clump of cactus, was five feet in diameter and completely covered with pebbles and sea shells. Another among the mangroves on Magdalena Island was six feet in diameter and composed entirely of mangrove twigs. Its base was well secured among elevated mangrove roots and more than a foot clear of the marshy ground beneath. There must have been a score of wood rat nests among the mangroves on Magdalena Island within a radius of 500 yards and many of the structures were five feet high. Any kind of portable object in the vicinity of a wood rat's nest may be used in its composition.

27. **Neotoma intermedia gilva.** *Rhoads.* YELLOW WOOD RAT.

Female, San Bartolome Bay, March 14.

28. **Neotoma intermedia pretiosa** *Goldman.* MATANCITA WOOD RAT.

Five males, 3 females, Santa Margarita Island, March 19–21.

29. **Neotoma intermedia arenacea** *Allen.* CAPE WOOD RAT.

Three males, 2 females, Cape San Lucas, March 24–25.

30. **Neotoma intermedia perpallida** *Goldman.* SAN JOSÉ ISLAND WOOD RAT.

Five males, 1 female, San José Island, March 31–April 1.

31. **Neotoma intermedia** *Rhoads.* RHOADS'S WOOD RAT.

Female, Agua Verde Bay, April 2; 2 females, Mulege, April 5, Concepcion Bay, April 8; female, San Bernado Mountains, May 16; 2 juv., Miraflores, April 25–30.

32. **Neotoma intermedia vicina** *Goldman.* ESPIRITU SANTO WOOD RAT.

Female, Espiritu Santo Island, April 19.

33. **Neotoma nudicauda** *Goldman.* CARMEN ISLAND WOOD RAT.

Two females, Carmen Island, April 3.

34. **Neotoma albigula seri** subsp. nov. TIBURON ISLAND WOOD RAT.

In color similar to *N. albigula*, which it resembles more nearly than any other species. Teeth rather small; interorbitals narrow; interparietals small as compared with *albigula*. Named for the Seri Indians inhabiting Tiburon Island.

Type No. 31940, male.

Represented by 1 male and 2 females, Tiburon Island, April 12-13.

Measurements, average of three specimens: total length, 328; tail, 149; hind foot, 34.

35. **Neotoma insularis** sp. nov. ANGEL ISLAND WOOD RAT.

Nearest to *N. intermedia gilva* and about the same size, but paler, grayer and less yellowish. Skull relatively shorter and broader, with heavier rostrum, heavier dentition and larger auditory bullæ.

Type No. 21922, female, Angel del la Guardia Island, April 11.

Measurements of type: total length, 290; tail, 120; hind foot, 35.

DEER MICE.

These nocturnal animals, abundant in most parts of North America, are common almost everywhere in Lower California and the outlying islands. The traps set for them at night seldom failed to yield specimens, but we learned little of their habits. They feed largely on seeds and inhabit all sorts of natural crevices under rocks and the roots of trees and bushes. They are extensively preyed upon by owls, snakes, and weasels.

36. **Peromyscus eremicus cedroscensis** *Allen.* CEDROS ISLAND MOUSE.

One male, 3 females, Cedros Island, March 10-12.

37. **Peromyscus maniculatus coolidgi** *Thomas.* COOLIDGE'S FIELD MOUSE.

Female, San Bartolome Bay, March 14.

38. **Peromyscus eremicus polypolius** *Osgood.* MARGARITA ISLAND MOUSE.

Three males, 4 females, Santa Margarita Island, March 19-21.

39. **Peromyscus eremicus eva** *Thomas.* EVA'S MOUSE.

Four males, Cape San Lucas, March 24-25; 1 male, San José del Cabo, March 26; 1 male, 1 female, Pichilinque Bay, March 28-30; 4 females, Mulege, April 5; 2 males, 1 female, Concepcion Bay, April 7–8; 1 female, San Bernado Mountains, May 15; 1 juv., Miraflores, April.

40. **Peromyscus eremicus eremicus** *Baird.* DESERT MOUSE.

Female, San Francisquito Bay, April 10.

41. **Peromyscus eremicus tiburonensis** *Mearns.* TIBURON DESERT MOUSE.

Two males, 1 female, Tiburon Island, April 12–13.

42. **Peromyscus guardia** sp. nov. ANGEL ISLAND MOUSE.

Larger than *eremicus*, in color at least as pale; upper outline of skull less arched; skull similar in general to that of *eremicus*, but zygoma more compressed anteriorly and rostrum decidedly longer. Incisive foramina rather short, not reaching anterior plane of first molars; interpterygoid fossæ broader; audital bullæ larger.

Type No. 31907 female.

Measurements: average of two specimens, total length, 208; tail, 114; hind foot, 24.

Represented by male and female from Angel de la Guardia Island, April 11.

43. **Peromyscus stephani** sp. nov. SAN ESTEBAN ISLAND MOUSE.

Although near to Tiburon Island, the San Esteban form is clearly not very nearly related to *P. tiburonensis*. In color it is close to typical *eremicus;* the tail averages shorter and the hind foot larger.

P. tiburonensis is one of the smallest of the *eremicus* group, while the San Esteban form is one of the largest, skull decidedly shorter than in *eremicus*, dentition about the same; nasals more pointed posteriorly and reaching beyond premaxillaries. In *eremicus* the contrary is true — the premaxillaries exceed the nasals. Posteriorly the frontals meet at an angle on the median line, instead of forming a curve as in *eremicus*.

Type, No. 31961, male.

Measurements, average of four specimens: total length, 195; tail, 97; hind foot, 22.

Represented by 2 males and 2 females, San Esteban Island, April 14.

44. **Peromyscus eremicus carmeni** subsp. nov. CARMEN ISLAND DESERT MOUSE.

Generally similar to *P. e. eva*, but back rather grayer and general color less rufescent, under parts more creamy white. Specimens vary from white to creamy white beneath; foot larger; teeth larger and tooth-row longer.

Type No. 31885, male.

Measurements, average of 12 specimens: total length, 197; tail, 111; hind foot, 22.

Represented by 5 males, 7 females, Carmen Island, April 13.

SCIURIDÆ. SQUIRRELS, SPERMOPHILES, ETC.

Antelope squirrels were observed at three localities only. We did not see them at any point on the west side of the Peninsula. All specimens were obtained by shooting.

45. **Ammospermophilus leucurus insularis** *Nelson and Goldman.* ESPIRITU SANTO ISLAND SPERMOPHILE.

Three males, 1 female, 2 skulls, Espiritu Santo Island, April 19.

46. **Ammospermophilus leucurus peninsulæ** *Allen.* LOWER CALIFORNIA SPERMOPHILE.

Five males, 1 female, Cape San Lucas, March 24; 1 skull, Agua Verde Bay, April 22.

VESPERTILIONIDÆ. INSECTIVOROUS BATS.

Bats were not much in evidence during our explorations, as we were seldom ashore in the evening. The specimens with one exception were obtained in the interior by a collector sent from the ship.

Several species are known to inhabit Lower California.

47. **Pipistrellus hesperus australis** *Miller.* ALLIED BAT.

One female, Ceralbo Island, April 19.

48. **Dasypterus ega xanthinus** *Thomas.* SIERRA LAGUNA BAT.

Two specimens, Miraflores, May 7.

49. **Antrozous pallidus minor** *Miller.* LITTLE COMONDU BAT.

Three specimens, Miraflores, May 1–3.

50. **Myotis peninsularis** *Miller.* LOWER CALIFORNIA BAT.

Five specimens, Miraflores, May 1–6.

PHOCIDÆ. SEALS.

One of the most interesting features of the expedition was the rediscovery of the elephant seal at Guadalupe Island, lying 140 miles west of the northern part of the Peninsula. This species was formerly taken in great numbers for its oil, and finally became so scarce that it was reported by Scammon in 1869 to be "nearly if not quite extinct." Specimens were taken by the writer in 1884 at San Cristobal Bay, Lower California, since which time it has not been seen at that locality. He also obtained specimens in 1892 at Guadalupe Island where it has been found subsequently only twice. Not having been found elsewhere than at these two localities since about 1865, it has generally been supposed to be extinct. The herd at Guadalupe Island contains about 150 animals, and is now being protected by the Mexican Government. The writer has already published a special account of the elephant seal in 'Zoologica, Scientific Contributions of the New York Zoological Society', I, No. 8, pp. 159–173, pll. 52–72, April, 1912. He has also published an article on the same subject in the 'Century Magazine' for June, 1912, pp. 205–211.

51. **Macrorhinus angustirostris** *Gill.* NORTHERN ELEPHANT SEAL.

Plate VIII.

Three males, 1 female, skins, 2 skeletons, 6 live yearlings, Guadalupe Island, March 2–4.

Some of the young brought back lived nearly a year in the New York Aquarium. The skins of the adults with some of the young have been mounted for the American Museum of Natural History.

OTARIIDÆ. SEA-LIONS, FUR-SEALS.

Sea-lions abound at many points on the Peninsula and the outlying islands, from Guadalupe Island, 140 miles west of the northern part of the Peninsula, to Consag Rock, near the head of the Gulf of California.

The California species has not been recorded from farther south than the Tres Marias Islands, below the mouth of the Gulf. The largest colony observed during the cruise occupied the western side of West San Benita Island, where there were perhaps 1000 hauled out on the rocks. All the little inlets on the eastern side of the East San Benita were filled with them, there being about 700 altogether.

A brief search was made for fur-seals at Guadalupe Island, and a very thorough one at the San Benita Islands, but none were found. The breeding season, it is said, does not commence until June. Doubtless there are some survivors about Guadalupe, where they were taken as late as 1894. At this island they frequented the numerous sea-caves under the cliffs. (Plate VIII.

52. **Zalophus californianus** *Lesson.* CALIFORNIA SEA LION.

One shot at Cedros Island, not saved.

53. **Arctocephalus townsendi** *Merriam.* LOWER CALIFORNIA FUR-SEAL.

This species has not been seen since 1894. There are no specimens in museums with the exception of those collected by the writer in 1892. There are incomplete records showing that 5575 fur-seals were killed at Guadalupe and San Benita Islands between 1876 and 1894.

MUSTELIDÆ. SKUNKS, WEASELS, ETC.

54. **Spilogale lucasana** *Merriam.* CAPE SAN LUCAS SPOTTED SKUNK.

Three specimens, Miraflores, May 2, 18, 19.

Spotted skunks of this or allied species are found in most parts of Lower California, where the inhabitants generally fear them, believing that the bite of a "*zorillo*" causes rabies.

PROCYONIDÆ. RACCOONS, ETC.

55. **Procyon psora pallidus** *Merriam.*

Male, female, Miraflores, April 24 and May 10.

CANIDÆ. WOLVES, FOXES, ETC.

The coyotes from San Bartolome and Tiburon were all obtained by leaving poisoned baits on the beaches at night. Foxes and coyotes appear to inhabit all parts of the Peninsula, and fox tracks were seen on Cedros Island.

56. **Urocyon cinereoargentatus californicus** *Mearns.* CALIFORNIA GRAY FOX.

Two females, Miraflores, May 2–8.

57. **Canis peninsulæ** *Merriam.* LOWER CALIFORNIA COYOTE.

Two males, 1 female, San Bartolome Bay, March 14.

58. **Canis jamesi** sp. nov. TIBURON ISLAND WOLF.

Plate IX.

Much paler than *C. mearnsi,* and nearer *C. estor,* the desert coyote, but of a richer color and a little more buff; ears long, skull large, nearly equalling that of the type of *estor;* teeth larger and heavier than in either *mearnsi* or *estor* — about equalling those of *lestes;* bullæ rather flattened, closely resembling those of *C. lestes.*

Type No. 31987, male, Tiburon Island, April 13.

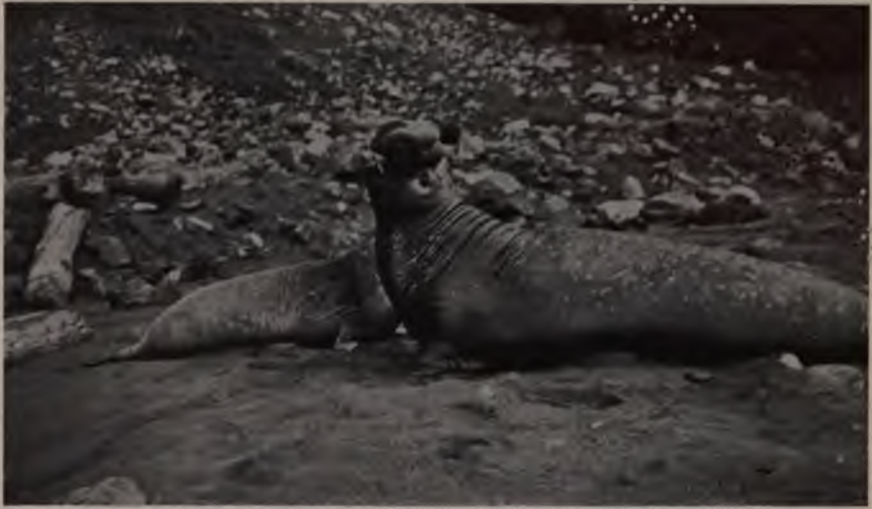
Measurements of the type: total length, 1143; tail vertebræ, 330; hind foot, 330; ear from crown, 118.

Named for Mr. Arthur Curtiss James of New York, through whose generosity the Museum was enabled to cooperate in the expedition of the 'Albatross' to the Gulf of California.

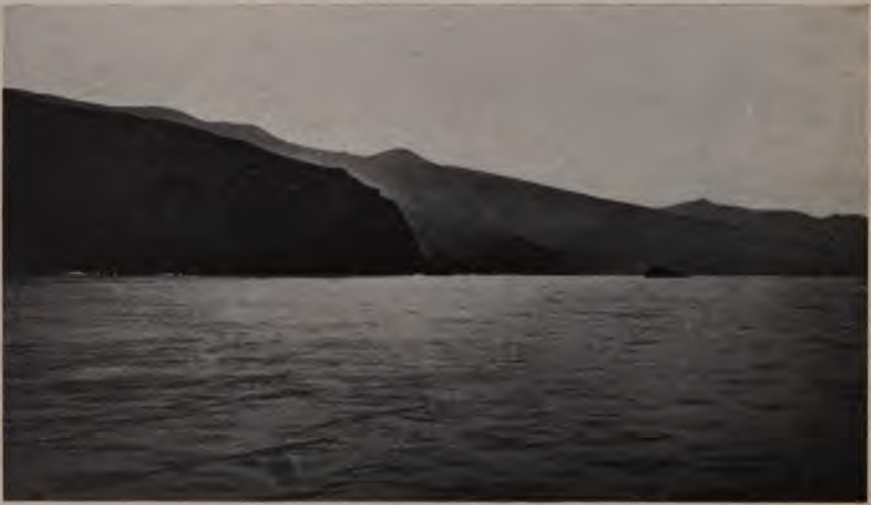
FELIDÆ. CATS.

59. **Lynx ruffus californicus** *Mearns.* CALIFORNIA LYNX.

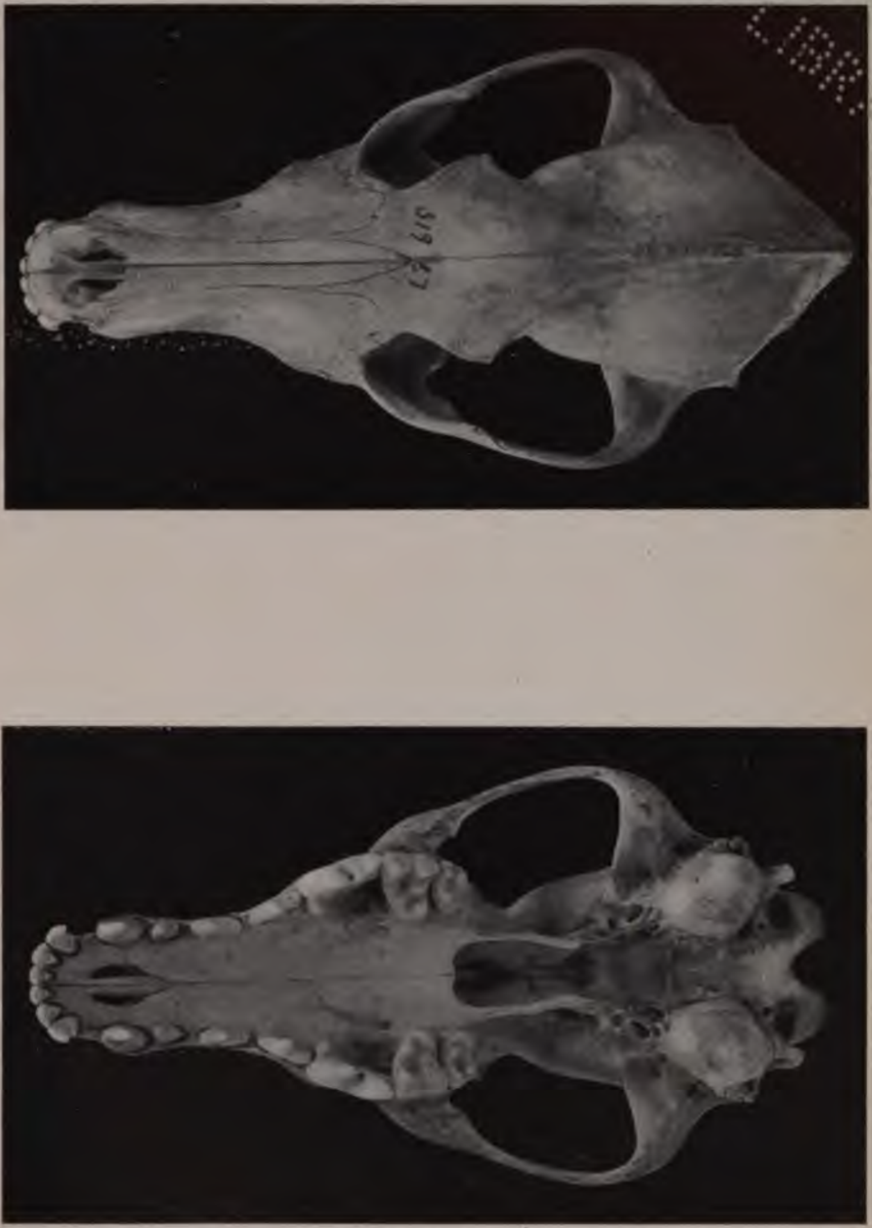
Male, Miraflores, May 21.



1. Adult male and female Elephant Seal (*Macrorhinus angustirostris*). Guadalupe Island, L. Cal.



2. View of northwest side of Guadalupe Island, L. Cal. Small beach at extreme left occupied by Elephant Seals in 1911. The rocky point in center is where Fur Seals were found in 1892.



Skull of Tiburon Island Wolf (*Canis jamesi*).

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Article XIV.— A CRESTED DINOSAUR FROM THE EDMONTON CRETACEOUS.

By Barnum Brown.

Plates X and XI.

During the past three years expeditions from the American Museum have explored the Edmonton formation exposed on the Red Deer River in Alberta, Canada. As a result of this work a large collection of new or little known vertebrate fossils was secured and the geological horizon in which they occur was determined to be a distinct formation, intermediate in age between the Lance and the Judith River (Belly River) Cretaceous. The collection will be monographed and the geology more fully discussed as soon as the material is completely prepared.

The subject of this preliminary paper is a new genus of the family Trachodontidæ which presents some anatomical features not heretofore known in the Dinosauria.

Saurolophus osborni gen. et sp. nov.

Type of genus and species, No. 5220, a nearly complete skeleton.

Paratype, No. 5221, a disarticulated skull and jaws.

Horizon and locality. Edmonton formation 500 feet below top of beds. Tolman Ferry, Red Deer River, Alberta, Canada.

Skull.

The most characteristic and striking feature of the skull (Plate X and text fig. 1*a* and *b*) is a long median, dorsal crest to which the generic name refers. The form, proportion and relation of other elements of the skull are, with minor differences to be pointed out later, similar to that of the genus *Trachodon*. This crest is a complex one, formed by a backward prolongation of the nasals, prefrontals and frontals. The posterior end is somewhat elevated above the anterior facial angle and judging from the contraction of the bones at the broken point, it was at least four inches longer, extending in life slightly beyond the posterior end of the parietals.

In position this crest is analagous to that of the chameleons but it has a different origin and may have served a different purpose.

The crest of *Chameleo* according to Parker[1] is composed of the inter-

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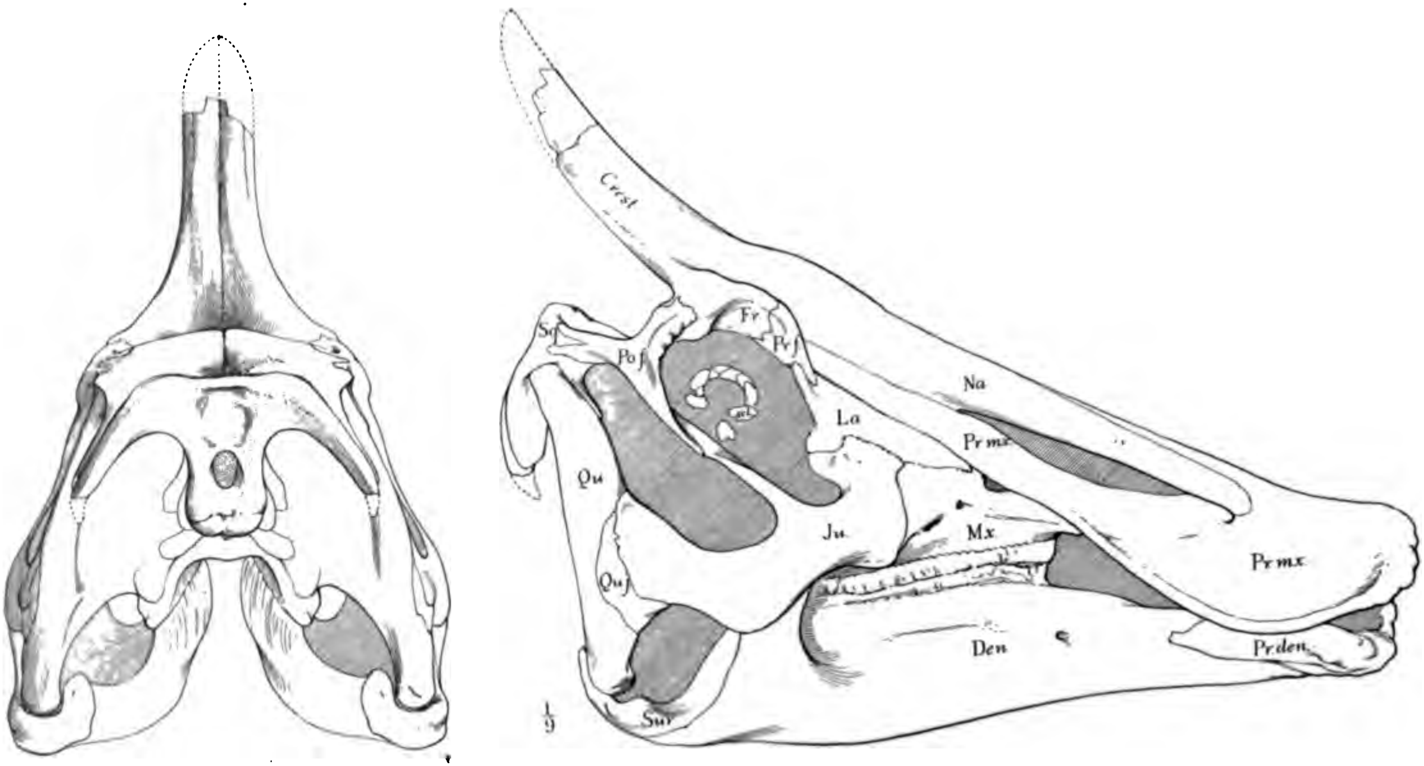
[1] Trans. Zool. Soc. London, Vol. XI, Part III, 1881, pp. 77–105; §15–19.



a.

b.

Fig. 1. ***Saurolophus osborni.***

a. Occipital view of skull, reconstructed from exposed half.

b. Right side of skull with point of crest restored.

parietal and the posterior end of the frontal and serves chiefly as attachment for the large *temporalis* muscle Mivart.[1] In this new animal the bones in the side of the face, the supratemporal arches and the back of the skull (Fig. 1) below the crest are similar in form and proportion to those of *Trachodon* in which there is no crest.

It is reasoned therefore that the main attachment of the *longissimus dorsi*, and *temporalis* muscles were as in *Trachodon.* To the crest were inserted the upper part of the *complexus, digastric* and the *superficial temporalis* muscles.

The crest near the posterior end on the dorsal face carries a series of fine ridges and in life it probably bore a frill as in the living lizard *Basiliscus.* This comparison is further borne out by the high spines of the mid-dorsal vertebræ which, like *Basiliscus,* probably carried a high median dorsal frill.

In profile the skull is triangular. Anteriorly it expanded in a broad duck-like bill similar to *Trachodon.*

Premaxillaries and predentaries alike bear pseudo tooth-like projections, undoubtedly covered by a horny beak in life.

The premaxillaries are formed as in *Trachodon* but the anterior recurved superior border is not so high and the posterior projecting processes are much longer. The superior process is exposed as far back as the posterior border of the narial opening where it disappears under the nasal (Fig. 2). The

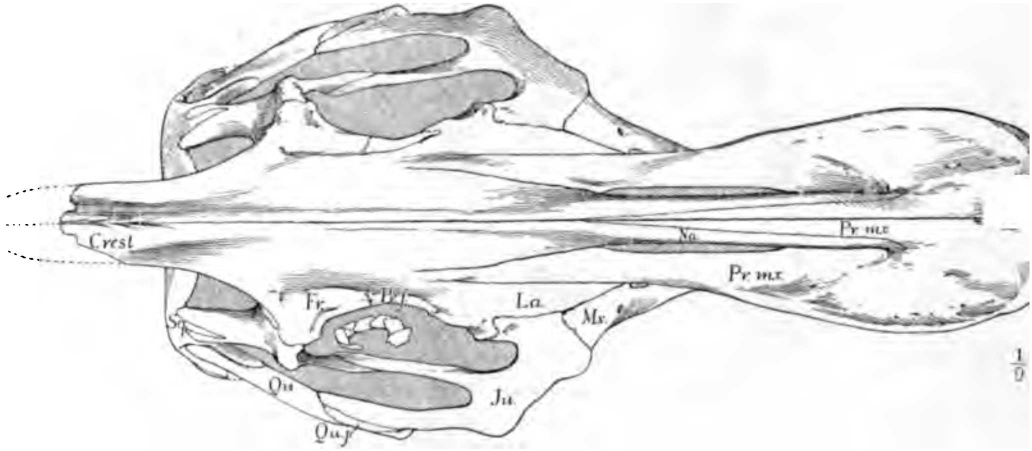


Fig. 2. *Saurolophus osborni.* Top view of skull, reconstructed from right half and viewed at right angles to line from premaxillary to end of crest.

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[1] Proc. Zool. Soc. London, 1870, pp. 850–890.

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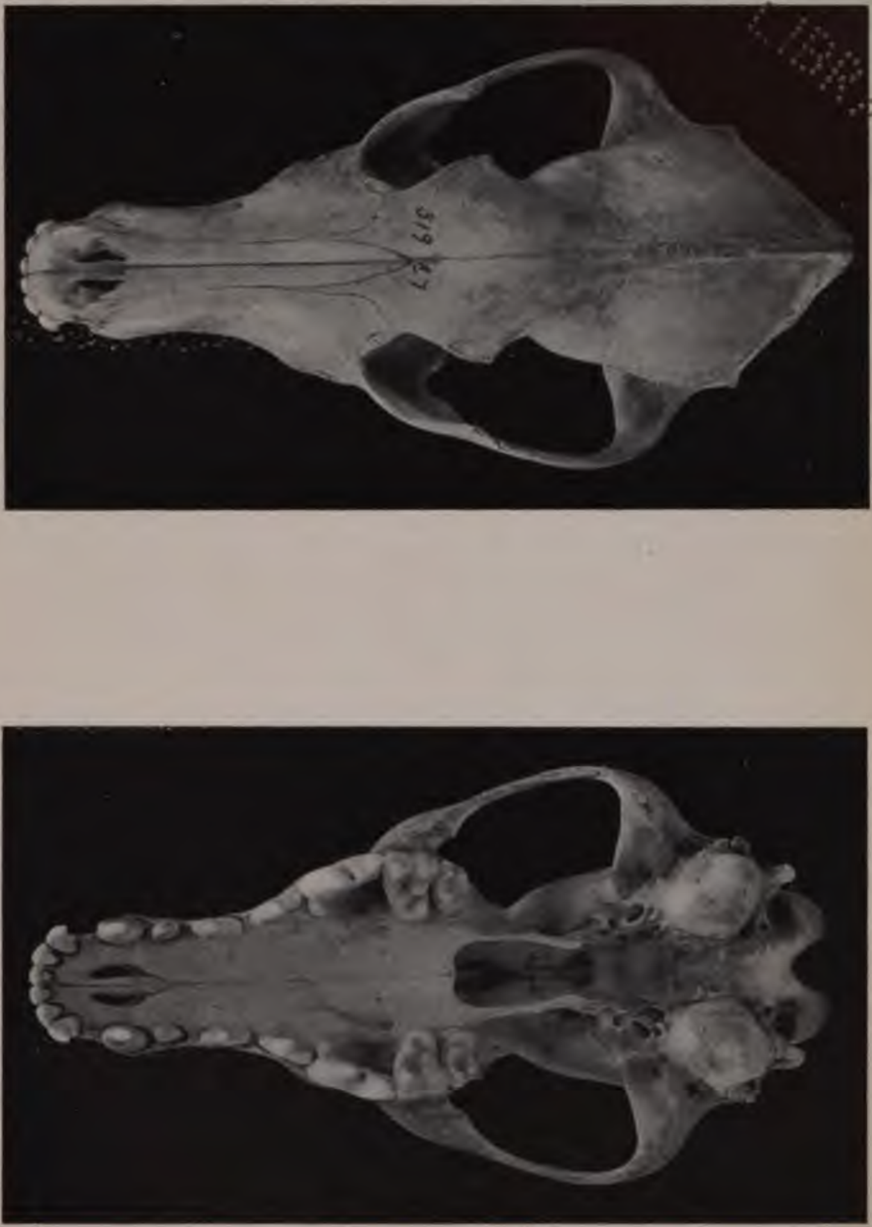
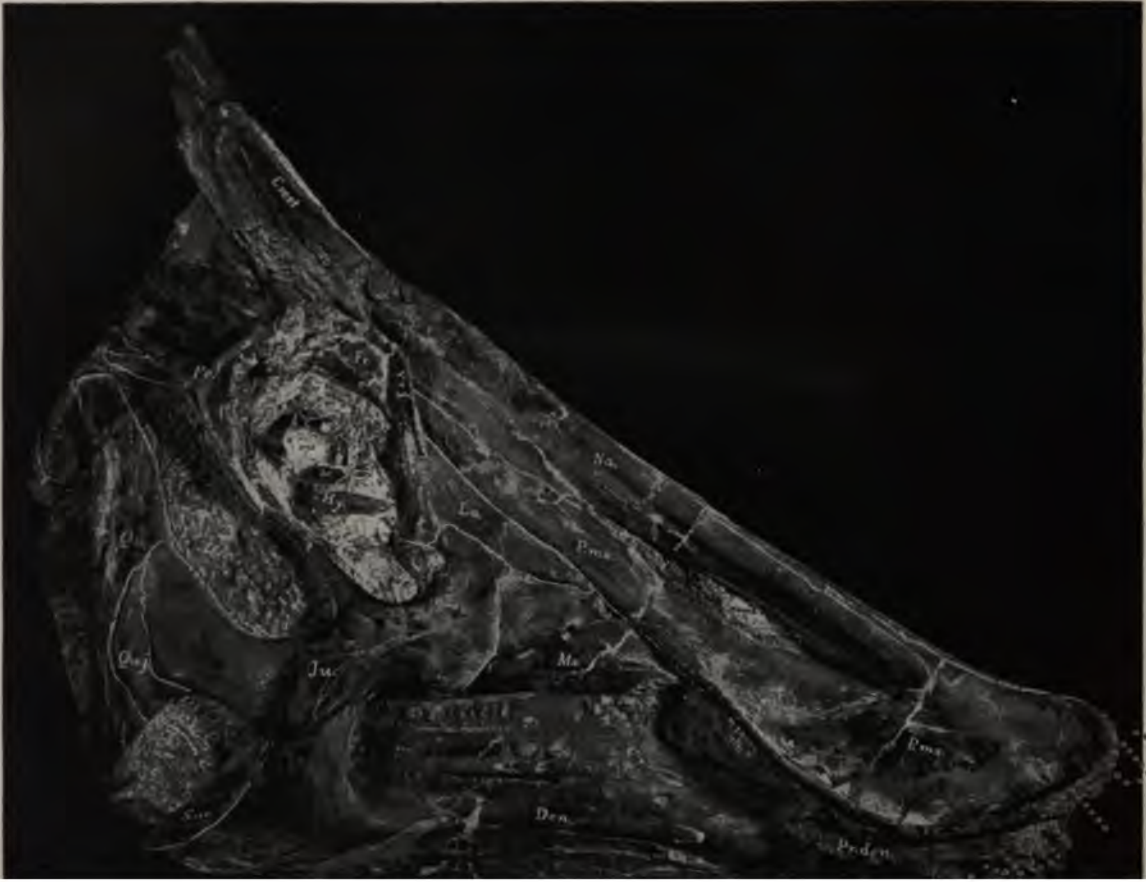


Skull of Tiburon Island Wolf (*Canis jamesi*).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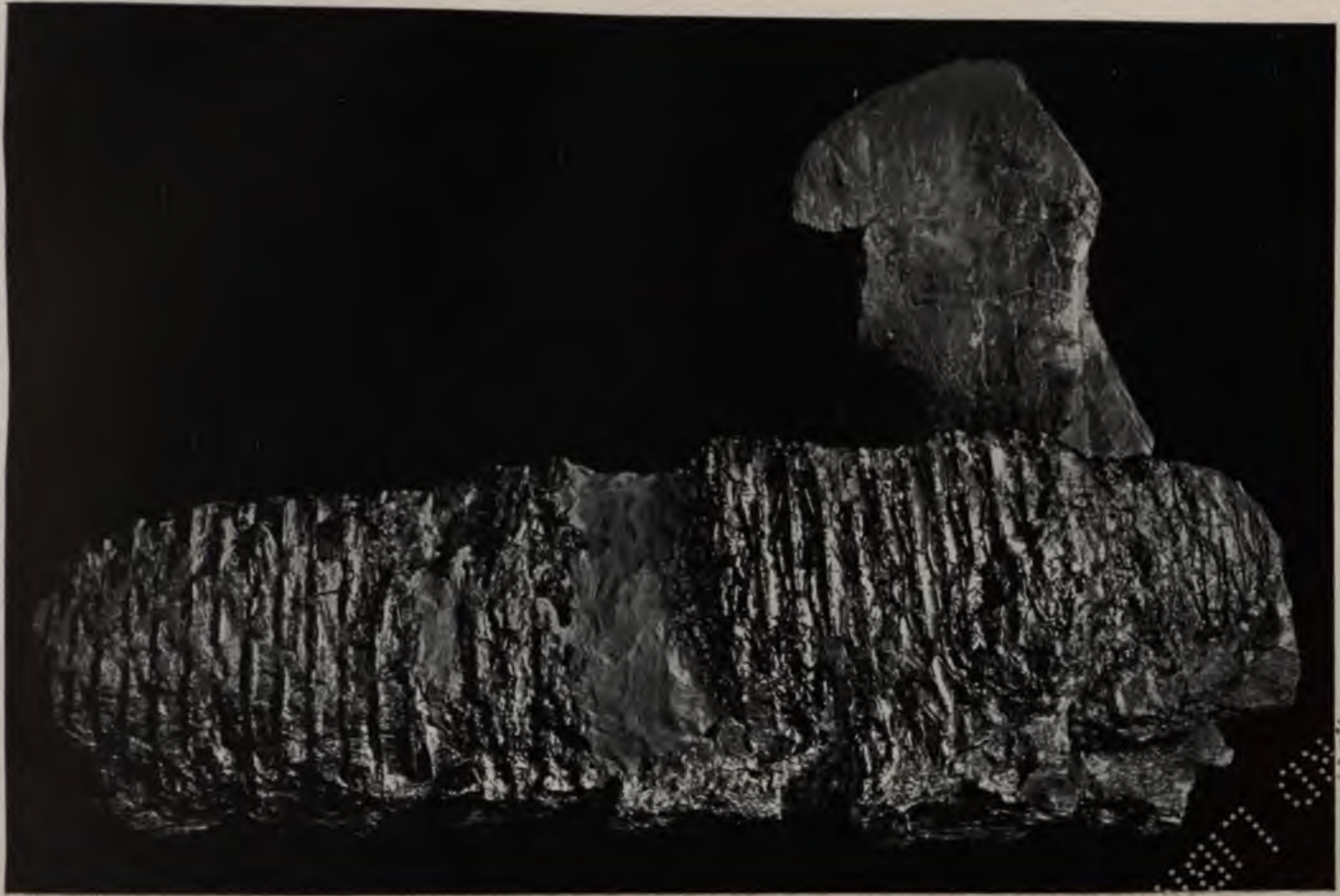

SAUROLOPHUS OSBORNI. $\frac{3}{5}$.

Lower jaw, inside view. Paratype. No. 5221 Am. Mus.

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Article XV.—DESCRIPTION OF A NEW SPECIES OF *ŒDIPOMIDAS.*

By D. G. Elliot, D. Sc., etc.

Œdipomidas salaquiensis sp. nov.

Type locality. Forest of the River Salaqui, northern Colombia. Type Am. Mus. No 33076, ♂ ad.

Color. Adult male. Face and sides of head covered with very short white hairs, skin black; throat naked, black; middle of forehead to crown white, the hairs starting at a point just above and widening as they go to crown; crown and nape dark chestnut, hairs ringed with black; forearms white, rest of arms, shoulders, entire upper parts and outer side of legs to ankles black mottled with cream buff; inner side of arms, lower part of throat and chest cream color rest of under parts of body and inner side of legs deep buff yellow; tail above jet black, a few chestnut hairs at the root, beneath chestnut at root, remainder jet black; hands and feet gray; ears black, naked.

Measurements. Total length, 600 mm.; tail, 395; foot, 75. Skull: total length, 59.7; occipito-nasal length, 50; hensel, 37.4; zygomatic width, 36.1; intertemporal width, 24.5; median length of nasals, 7.3; breadth of braincase, 27.6; palatal length, 18; length of upper molar series, 10; length of mandible 31.9; length of lower molar series, 12.4.

This species, while having a general resemblance to *Œ. geoffroyi*, is larger and differs in the coloring of its coat in the following respects: the crown and nape are dark chestnut instead of burnt umber, the mottling is cream color on inner side of arms and chest, and buff yellow on rest of under parts and inner side of legs instead of all these parts being pure white. The cranial characters are very different. The skull is much larger in its dimensions; the palate is wider and longer; the bullæ longer and higher, the zygomatic arch longer and wider; the braincase broader and occipital region broader and more rounded; nasals broader and longer; mandible much heavier, the ascending ramus much broader at line of tooth row, being 13.1 mm. to 11.5 of *Œ. geoffroyi*, with the angle more prominent. The orbits are much wider the outer dimensions across both being 27.5 for the present species to 25.4 for *Œ. geoffroyi*.

The present species was procured by Mrs. E. L. Kerr (who also discovered the striking *Seniocebus meticulosus* lately described) in the forest of the River Salaqui, among the coast mountains of northwestern Colombia. It would appear to be a larger animal than its relative from Costa Rica and Panama. It is not probable that the ranges of the species approach each other as the Salaqui River is a considerable distance to the south of the northern border of Colombia.

Description of Male.— Upperparts brownish olivaceous, somewhat browner on the rump and upper tail-coverts, tail with a brownish tinge. Wings externally like the back, the primaries and their coverts blacker; chin blackish. front and sides of throat mars-brown more or less well defined from the chestnut-rufous breast and underparts; under tail-coverts like the belly but with some olivaceous. Wing, 245; tail, 270; tarsus, 70; culmen, 26 mm.

Description of Female.— Resembles the male in color but is somewhat smaller, and the three outer primaries are not so deeply or so sharply incised. Wing, 235; tail, 258; tarsus, 68; culmen, 25 mm.

Remarks.— Twelve specimens of *Chamæpetes g. goudoti* from the Western and Central Andes of the Cauca, including nine from the Quindio Pass, the type locality of the species show, on comparison, that the series of fourteen specimens from the Santa Marta Mountains referred by Dr. Allen to *C. goudoti* represent a well-marked species characterized as above. As a whole these birds exhibit little variation in color. In two specimens the throat is almost as richly rufous as the breast, while in two others the entire underparts, except the throat, is faintly barred with dusky.

Leptotila verreauxi occidentalis subsp. nov.

Char. subsp.— Most closely allied to *Leptotila verreauxi verreauxi* Bp. but upperparts, wings and tail externally much grayer, more olivaceous, forehead whiter, reflections of crown much less pronounced and obscured by grayish, underparts paler, less vinaceous; flanks somewhat grayer; under tail-coverts averaging more buffy.

Type.— No. 108696, Am. Mus Nat. Hist., ♂ ad., San Antonio, alt. 6600 ft., Western Andes, Cauca, Colombia, April 7, 1911; F. M. Chapman, W. B. Richardson. Wing, 132; tail, 103; tarsus, 29; culmen, 17.5 mm.

Remarks.— Several authors have commented on the paler colors of specimens of *Leptotila verreauxi* from western Colombia and western Ecuador (*cf.* Salvadori, Cat. B. M., XXI, p. 549, and Hartert, Nov. Zool., V, 1898, p. 503), but so pronounced and constant are its characters that one can only assume it has heretofore escaped recognition by name through the inadequate material by which it has been represented. Comparison of twenty specimens from western Colombia with twenty-six specimens of *L. v. verreauxi* from Trinidad, Venezuela, Santa Marta, "Bogota," and the Magdalena Valley in Colombia, Panama, Chiriqui and Costa Rica, show that the differences between the two forms expressed in the preceding diagnosis are constant, and are not bridged by individual or seasonal variation. While a specimen labelled "Bogota," which we may consider the type locality, is as richly colored as any bird in the series; two specimens from Chicoral Bridge in the foothills of the eastern slopes of the Central

Andes, opposite Giradot, and a third from Puerto Berrio on the Magdalena River, show some approach toward the Cauca form. *Leptotila v. occidentalis* is a common bird in the Cauca region, ranging from 1800 feet at Caldas to about 8500 feet, and living chiefly about the borders of forests. Our specimens are all from the mountains as follows: Caldas, San Antonio, and Cerro Munchique in the Western Andes, Miraflores, and Salento in the Central Andes.

Pionopsitta fuertesi sp. nov.

Char. sp.— Most nearly related to *Pionopsitta amazonina* (Des Murs) but face yellow, crown blue.

Type.— No. 111470, ♂ ad., Laguneta, alt. 10,340 ft., near Quindio Pass, Cauca, Colombia, August 31, 1911; A. A. Allen; L. E. Miller.

Male adult.— Above parrot-green, back with an olivaceous wash, nape, rump and upper tail-coverts brighter, more yellow; forehead, lores, superciliaries and entire sides of the head greenish yellow, crown blue; rectrices from above very dark maroon, green basally, and more or less medianly, the ends for 20 mm. or more cyanine-blue; rectrices from below rich turquoise, basally brownish and with more or less green on the inner margins of particularly the inner feathers; greater wing-coverts and inner wing-quills externally green, the tertials more olivaceous, outer quills black, their exposed margins, except apically and those of primary coverts, cyanine-blue very narrowly bordered by green; lesser, upper, and under wing-coverts and bend of the wing geranium-red, pinker on the border of the bluish outer coverts, deeper on the inner coverts; greater under wing-coverts rich turquoise; axillars in molt, but apparently to become mixed green and red; underparts greenish yellow or yellowish green, not quite so yellow as the forehead, the flanks and under tail-coverts less yellow, the sides of the breast and centre of the abdomen with traces of red.

Wing, 149; tail, outer feather, 74; central feather, 93; culmen, 21 mm.

Female adult.— An adult female in somewhat worn plumage resembles the male but has the forehead less broadly defined, the crown duller, a single upper tail-covert red, less red on the lesser wing-coverts and more red on the center of the abdomen, and traces of red in the malar region, and no green border to the blue of the primaries. These differences appear to be due to age, to wear, and individual variation rather than to sex.

Immature.— Immature birds have but a trace of the blue crown-patch, less red in the tail, which is more largely green with narrow blue ends which are tipped with green, the red of the wing-coverts much restricted and of the same color as the red of the tail, the bend of the wing faintly red, and lesser under wing-coverts green.

Remarks.— This species which is represented by seven specimens taken at Laguneta and Santa Isabel in August and September, is with the exception of *P. amazonina*, the only known red-tailed member of its genus. The tail also differs in shape from the prevailing type in *Pionopsitta* being more pointed the central feathers extending beyond the outer pair for 25 mm.

I have named this interesting bird in honor of Mr. Louis Agassiz Fuertes, in recognition of the service which, not alone as artist, but in many other capacities he rendered the Museum's Colombian expedition.

Capito maculicoronatus rubrilateralis subsp. nov.

Capito maculicoronatus (nec Lawr.) HELLMAYR, P. Z. S., 1911, p. 1198.

Char. subsp.— Similar to *Capito maculicoronatus maculicoronatus* Lawr. but larger, bill stouter, side-patch mainly vermilion rather than mainly orange, crown averaging whiter; male with the pectoral band paler.

Type.— No. 111764, ♂ ad., Juntas de Tamaná, alt. 800 ft., Cauca, Colombia. December 17, 1911; A. A. Allen; L. E. Miller.

Remarks.— This well-marked form is based on twelve adult specimens from the following localities, all in the humid littoral zone: Juntas, 2♂♂; Nóvita, 1♀; San José, 1 ♂, 6 ♀♀; Los Cisneros, 2 ♂♂. Comparison of these birds with six topotypes of *C. m. maculicoronatus* shows the differences set forth in the preceding diagnosis to be constant. The differences in the size of the two forms are indicated by the appended measurements:

	Wing	Tail	Culmen	Depth of bill at nostril
C. m. maculicoronatus average of 2 males	78	45.5	22	9.7 mm.
C. m. rubrilateralis average of 5 males	82	50	23	10.5 mm
C. m. maculicoronatus average of 4 females	76.5	46.5	21	9.5
C. m. rubrilateralis average of 5 females.	82	49	22	10

Veniliornis nigriceps equifasciatus subsp. nov.

Char. subsp.— Similar to *Veniliornis nigriceps nigriceps* (Lafr. & D'Orb.) but olive-green and yellowish bars on underparts of equal width.

Type.— No 111819, Am. Mus. Nat. Hist., ♂ ad., Santa Isabel, Quindio Andes, alt. 12,000 ft., Sept. 18, 1911; A. A. Allen; L. E. Miller.

Remarks.— In addition to the type an immature male was collected at the same locality on the same date. It agrees with the type but has no red on back, the red of the crown has a slight orange tint, and the yellowish bars on the underparts are paler. Compared with an adult famale of *nigriceps* from Marpiri, Bolivia, *equifasciatus* may be at once distinguished by having the yellowish bars of the underparts wider, the olive-green bars narrower. The underparts of the Bolivian bird may be described as dull olive-green narrowly barred with yellowish buff, the olive area on the breast being at least twice as wide as the yellowish area, while the feathers are narrowly tipped with olive. The bars on the underparts of *equifasciatus*, however, are of equal width and the feathers are narrowly tipped with yellowish. A male from Mt. Pichincha in the Philadelphia Academy of Natural Sciences shows some approach toward *nigriceps* in having the olive bars on the breast slightly wider than the yellowish ones, but is evidently to be referred to *equifasciatus*.

Rhamphocænus rufiventris griseodorsalis subsp. nov.

Char. subsp.— Similar to *Rhamphocænus rufiventris rufiventris* Bp. but with the back slaty smoke-gray, the head less rufous gray, slightly tinged with cinnamon which is stronger, more ochraceous on the forehead; sides of the head less strongly ochraceous-buff; but ochraceous-buff of underparts, particularly of abdomen, deeper.

Type.— No. 108936, Am. Mus. Nat. Hist., ♀ ad., Miraflores, alt. 6800 ft., Central Andes, east of Palmira, Cauca, Colombia, April 18, 1911; F. M. Chapman. Wing, 48; tail, 43; tarsus, 20; culmen, 21.

Remarks.— A second specimen taken by Allen and Miller in November, near Salento, agrees with the type. For comparison with these two Cauca birds I have two specimens of *rufiventris* from Guatemala (type locality), two from Costa Rica, one from Panama, and eight from Santa Marta, Col. The latter (*R. r. sanctæ-marthæ* Scl.) differ from Central American specimens chiefly in their somewhat larger size and longer bill, the cinnamon of the head and nape being nearly as strong as in true *rufiventris*. *R. r. griseodorsalis* differs from *sanctæ-marthæ*, therefore, essentially as it does from *rufiventris*; its gray back, without trace of cinnamon, being its best character.

Drymophila caudata striaticeps subsp. nov.

Char. subsp.— Similar to *Drymophila caudata caudata* (Scl.)[1] but male with the whole top of head uniformly streaked with white; concealed white interscapular patch smaller.

Type.— No. 111918, Am. Mus. Nat. Hist., ♂ ad., alt. 9000 ft., Central Andes, above Salento, Cauca, Colombia, November 6, 1911; A. A. Allen; L. E. Miller.

Remarks.— In addition to the type this form is based on six adult males and three females from the following localities: Western Andes, west of Popayan, Cocal, alt. 4000 ft., three; Gallera, alt. 5700 ft., two; Western Andes west of Cali, Las Lomitas, alt. 5000 ft., one; Central Andes, east of Palmira, alt. 6800 ft., Miraflores, two (Fuertes); Central Andes, El Roble, 7200 ft., one.

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[1] *Formicivora caudata* Scl., P. Z. S., 1854, p. 74.

All the males agree in lacking the black crown-patch of true *caudata*, all the feathers of the crown and nape being evenly and uniformly margined with white. The females differ from a single, not fully mature, female from Santa Marta, in being more heavily striped above, but this variation may be due to the immaturity of the Santa Marta specimen, the only female of *caudata* available.

Of the male of *caudata* I have two adults from Santa Marta. Both agree with the figure of the Bogotá type in having a black, unstreaked crown-patch.

Formicarius rufipectus carrikeri subsp. nov.

Formicarius rufipectus (nec Salvin) BANGS, Proc. Biol. Soc. Wash., XXI, 1908, 157; CARRIKER (part), Ann. Carnegie Mus., VI, 1910, 626; RIDGWAY (part), Bull. U. S. Nat. Mus. 50 part V, 125.[1]

Formicarius rufipectus rufipectus (nec Salvin) HELLMAYR, P. Z. S., 1911, 1174.

Char. subsp.— Similar to *Formicarius rufipectus rufipectus* Salv., but back, sides and flanks pronouncedly grayer; wings somewhat grayer, breast paler, averaging nearer orange-rufous than chestnut, as in *rufipectus*, the center of the abdomen much paler, ochraceous rather than chestnut.

Type.— No 113252, Am. Mus. Nat. Hist., ♂ ad., San Antonio, alt. 6600 ft., Cauca, Colombia, March 31, 1911; Louis A. Fuertes.

Remarks.— Evidently insufficient material of both forms has heretofore led authors to refer this race to *F. r. rufipectus* of Veragua, but comparison of three specimens from Central America with thirteen from Cauca shows constant and well-marked differences. These were recognized by Carriker but having only a male from Costa Rica and a female from San Antonio he attributed them, not unnaturally, to sexual, rather than to geographic variation. As a matter of fact, my series of ten males and three females apparently shows that the sexes are essentially alike in color, the females being only slightly more olivaceous above than some males, and agreeing exactly with others. There is no sexual difference in the colors of crown and underparts which is not fully covered by the range of individual variation in the male.

Formicarius rufipectus carrikeri is a common inhabitant of the heavy forests of the 'cloud' zone (alt. 5000 to 10,000 ft.) of both the Western and Central Andes; but the nature of its haunts and habits make it a difficult bird to secure. Our series contains specimens from the western range, west of Popayan, and San Antonio and Las Lomitas, west of Cali, and Salencio between Cartago and Nóvita; and from the Central Andes at Miraflores east of Palmira, and at El Roble near Salento. For comparison with this Colombian material, I have a male and female of *rufipectus,* secured by Batty at Chitra, Chiriqui, March 5, 1901, and a male collected by Carriker (type of his "*Formicarius castaneiceps*") at Juan Viñas, Costa Rica, May 7, 1907, kindly loaned me by W. E. Clyde Todd of the Carnegie Museum.

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[1] Doubtless references to Ecuadorian specimens which have been called *rufipectus* (*cf.* Hellmayr, *l. c.*) should also be placed here.

I have named this form for M. A. Carriker, Jr., in recognition of his important contributions to neotropical ornithology, as well as because he was the first ornithologist to describe its characters.

Grallaria milleri sp. nov.

Char. sp.— Apparently most nearly allied to *Grallaria erythrotis* Scl. & Salv., but ear-region brownish ochraceous, not "distinct red"; back deep bistre, not "cineraceous olive."

Type.— No. 111994, Am. Mus. Nat. Hist., ♀ ad., Laguneta, alt. 10,300 ft., Central Andes, near Qunidio Pass, Cauca, Colombia, Sept. 7, 1911; A. A. Allen; L. E. Miller.

Female adult.— Above, deep, rich raw-umber, crown of the same color as the back, lores whitish with a slight admixture of black; ear-coverts and auricular region more ochraceous than back; rump slightly paler than upper tail-coverts which are of the same color as the back; tail fuscous, its exposed portions slightly more olivaceous or, in some specimens, more rufescent than back; exposed portions of wing-quills essentially like the tail, the wing-coverts more like the back in color, two outer primaries nearly uniform fuscous with little if any brownish on their outer margin; under wing-coverts orange-tawny, inner margins of inner wing-quills narrowly ochraceous for about the basal half, throat grayish white, sides of the throat and a broad breast band tawny-olive, sides and flanks more olivaceous; abdomen smoke-gray, medianly creamy-white; under tail-coverts mixed gray, and olivaceous; thighs sepia; feet and bill blackish, the tip of the latter horn-color. Wing, 85; tail, 53; tarsus, 42; culmen, 19 mm.

Male adult.— Resembles the female in color and in size.

Immature.— Four specimens with traces of juvenal plumage show that this plumage is succeeded by the plumage of the adult. Black feathers on the sides of the throat appear to be the last evidences of immaturity. A male taken at Laguneta, September 16, 1911, has the hindcrown and nape dark brown with ochraceous-buff shaft-streaks; the scapulars with a few similarly colored but ochraceous tipped feathers, while the flanks and abdomen still have several dusky feathers with broad ochraceous-buff bars, and there are black feathers at the sides of the throat. Aside from these vestiges of immaturity the bird resembles the adult but is somewhat more olivaceous, the ochraceous colors of the underparts, especially, being duller.

Remarks.— This apparently distinct species, which is based on seven specimens, all from near the type locality, is dedicated to Mr. Leo E. Miller, whose efficient management of the transportation department of the Museum's Colombian expedition has contributed in no s
success.

Grallaria alleni sp. nov.

Char. sp.— Allied to *Grallaria varia* (Dodd.) but distinguished chiefly by its darker upperparts, whitish unmarked belly, black markings in the malar streak, and other characters.

Type.— No. 112005, Am. Mus. Nat. Hist., ♀ ad., Salento, alt. 7000 ft., Central Andes, Cauca, Colombia, Oct. 2, 1911; A. A. Allen.

Description of Type.— Crown and nape to malar stripe slate-color, the feathers very narrowly ringed with black and without evident shaft-streaks; forehead and whitish lores tinged with russet; back deep olivaceous bistre, the feathers conspicuously ringed with black, but without evident shaft-streaks; tail deep tawny; inner wing-quills and wing-coverts externally the color of the back; exposed margin of outer quills browner, that of the outer primary clay-color; primary-coverts black; ear-coverts like the back but with a slight rusty tinge and enclosed posteriorly by the slate of the nape; malar streak broad, white, the feathers more or less margined with black or olivaceous; chin and upper throat mixed russet, black and olive-bistre; lower throat and breast somewhat paler than back, the former with a white patch, the feathers of which are narrowly margined or spotted with black; feathers of the centre of the breast with median white stripes which are margined with black; olive-bistre of breast passing gradually into the creamy white, unmarked belly; long flank feathers rich ochraceous under tail-coverts, and under wing-coverts somewhat brighter; bill and feet brownish black. Wing, 113; tail, 38; tarsus, 43; culmen, 25 mm.

Remarks.— This well-marked species, which is represented only by the type, appears to introduce the *Grallaria varia* type into the Andean region. I have named it in honor of its collector, Mr. Arthur A. Allen, in recognition of the service he has rendered science as a member of the Museum's Colombian expedition.

Upucerthia excelsior columbiana subsp. nov.

Char. subsp.— Similar to *Upucerthia excelsior excelsior* Scl. but bill stouter and longer, superciliary and light areas of underparts whiter, brownish areas below hair-brown rather than broccoli-brown.

Type.— No. 112012, Am. Mus. Nat. Hist., ♂ ad., Paramo of Santa Isabel, alt. 12700 ft., Central Andes, Colombia, Sept. 15, 1911; A. A. Allen; L. E. Miller.

Remarks.— This well-marked race, which apparently introduces the genus *Upucerthia* into Colombia, is represented by twenty specimens, all collected at the type locality in September. While they show some variation in the intensity of the color of the upperparts, dependent upon the fresh or worn condition of the plumage, all agree in lacking the buffy suffusion of the superciliary and underparts which characterizes true *excelsior*. The latter is represented, in this connection, by two specimens in the American Museum collection and by three males from the Philadelphia Academy of Sciences collected by S. N. Rhoads on Mt. Pinchincha (the type locality) in May, 1911. These birds average, wing, 112; tail, 84; tarsus, 33; culmen 24.5 mm., while five males of *columbiana* average, wing, 114; tail, 85; tarsus, 31; culmen, 27 mm.

Synallaxis gularis rufipectus subsp. nov.

Char. subsp.— Similar to *Synallaxis gularis gularis* Lafr. but decidedly darker, more russet above, entire underparts, except throat, bright rusty cinnamon, bill slightly larger and heavier.

Type.— No. 112040, Am. Mus. Nat. Hist., ♂ ad., Laguneta, alt. 10,300 ft., Central Andes, west of Quindio Pass, Sept. 6, 1912; A. A. Allen; L. E. Miller. Wing, 58; tail, 52; tarsus, 23; culmen, 14 mm.

Remarks.— Of this bird the collection contains two specimens from Laguneta, the type and a male taken in May by L. A. Fuertes, and four taken in July, at an altitude of 10,340 ft. in the Western Andes, west of Popayan. While it is evidently a representative of the "Bogota" form, which may be considered to represent the type of *gularis*, and of which I have two specimens, its differences are so pronounced as to suggest specific distinctness. Ridgway's 'Nomenclature' contains no color approaching the bright rusty of the back of our specimens of true *gularis*, as compared with the deep cinnamon-russet of the upperparts of *rufipectus*, while the grayish breast of *gularis* is in strong contrast with the ochraceous-cinnamon which uniformly covers the breast and abdomen of *rufipectus*, the sides being slightly deeper in tone.

Synallaxis gularis cinereiventris subsp. nov.

Char. subsp.— Similar to *Synallaxis gularis gularis* Lafr. but darker above and grayer below; the bill slightly longer.

Type — No. 100746, Am. Mus. Nat. Hist., ♂ ad., Quintero, alt. 9,250 ft., near Merida, Venezuela, Jan. 13, 1903; S. B. Gabaldon. Wing, 55; tail, 58; tarsus, 20; culmen, 14.

Remarks.— Three specimens of *Synallaxis* from Merida agree very closely with one another in having the underparts, except the white throat, broccoli-brown, tinged with cinnamon, which is much stronger, nearly pure cinnamon, on the flanks and under tail-coverts. They thus differ markedly from *S. g. gularis* in which the gray of the underparts is median, and from *S. g. rufipectus*, which has the underparts, posterior to the throat, uniform ochraceous-cinnamon. Above, *cinereiventris* resembles *rufipectus* but averages slightly brighter.

Specimens of this species are apt to be in such worn plumage that accurate measurements cannot always be obtained. However, the following are believed to be dependable as far as they go:

	Sex	Wing	Tail	Tarsus	Culmen	
S g. gularis	—	60	60	21	13	mm.
S. g. rufipectus	♂	58	55	21	14	"
S. " "	♀	56	52	21	13	"
S. g. cinereiventris	♂	55	58	20	14	"
S. " "	♂	55	58	19	14	
S. " "	—	57	57	21	14	

It would thus appear that in *gularis* and *cinereiventris* the tail is as long or longer than the wing, while in *rufipectus* it appears to be shorter, but additional material may alter this showing.

Picolaptes lacrymiger sanctæ-marthæ.

Picolaptes lacrymiger (nec Des Murs) SALV. & GODM., Ibis, 1880, 171; BANGS, Proc. Biol. Soc. Wash., XIII, 1899, 100; ALLEN, Bull. Am. Mus. Nat. Hist., XIII, 1900, 156

Char. subsp.— Similar to *Picolaptes lacrymiger lacrymiger* (Des Murs) but throat slightly paler, the feathers more narrowly, or not at all margined with black, underparts grayer, less brownish olivaceous, and more heavily streaked, the streaks broader, linear rather than guttate, not enclosed at the end by their black lateral border, and extending to and on the under tail-coverts with little or no decrease in width.

Type.— No. 72872, Am. Mus. Nat. Hist., ♂ ad., Valparaiso, alt. 5000 ft., Sierra Nevada of Santa Marta, Colombia, May 31, 1899; G. H. Hull. Wing, 104; tail, 87; tarsus, 28; culmen, 27 mm.

Remarks.— On comparison of thirty-two specimens from the Santa Marta mountains with twenty-two typically representing *P. l. lacrymiger* (three from 'Bogota,' the type locality, and nineteen from the Andes of the Cauca) the characters separating them appear to be so constant as to suggest their specific distinctness, but four specimens from near Merida, Venezuela (which doubtless may be considered as representing *Picolaptes lafresnayi* Cab. & Hein., type locality, Caracas) while clearly to be referred to *P. l. lacrymiger* show some approach toward *sanctæ-marthæ* in their somewhat broader streaking below, but in other respects they agree with *P. l. lacrymiger.*

Xenicopsis subalaris columbianus subsp. nov.

Xenicopsis subalaris subalaris (nec Scl.) HELLMAYR, P. Z. S., 1911, pp. 1151 (provisional identification).

Char. subsp.— Similar to *Xenicopsis subalaris subalaris* Scl. but slightly larger, the throat paler, maize-yellow rather than buff-yellow, the underparts paler, more olivaceous, the streaks paler, and, especially on the breast, wider and more numerous.

Differs from *X. s. lineatus* in its paler and more heavily streaked underparts and less rufescent upperparts, the crown being olive-bistre rather than mummy-brown.

Type.— No. 108906, Am. Mus. Nat. Hist., ♂ ad., Miraflores, alt. 6800 ft., Central Andes, Cauca, Colombia, April 22, 1911; F. M. Chapman; W. B. Richardson.

Remarks.— Specimens from Cerro Munchique, Gallera, San Antonio, Las Lomitas and Salencio (eight in all) agree with the type, and, as Hellmayr (*l. c.*) has said of a specimen from the Western Andes, resemble the western Ecuador form in the color of the back but are larger. It is, however, in the coloration of the underparts that the Colombian bird differs most noticeably from both the Ecuador and Central American forms. Indeed in this respect, the last-named races more nearly resemble one another than they do the geographically intermediate *columbianus*. The range in size is not great as the following measurements of adult males show:

	Wing	Tail	Culmen
Chunchi, alt. 7200 ft. E. Ecuador	85	79	18
Miraflores, alt. 6800 ft. Colombia	90	80	18
" " " " " (Type)	87	82	18
Panama	92	82	19
Santa Maria de Data, Costa Rica	91	24	18

Knipolegus columbianus sp. nov.

Char. sp.— A small Flycatcher (length, skin, 138 mm.) apparently most nearly related generically to *Knipolegus* but bearing no close resemblance in color to any described species of that genus; general color gray, the inner webs of the tail-feathers largely cinnamon-rufous, center of abdomen and patch on throat buff.

Type.— No. 109727, Am. Mus. Nat. Hist., ♂ ad., alt. 10,340 ft., Western Andes, west of Popayan, July 20, 1911; W. B Richardson; L. E. Miller.

Description of Type.— Upperparts dark mouse-gray, the crown slightly darker, the rump slightly paler, the upper tail-coverts faintly tinged with brown; tail fuscous, the inner webs of all but the middle pair of feathers cinnamon-rufous, except the tip and shaft portion of the apical half of the feather, this color of nearly the same extent on all the feathers; wings fuscous, the inner webs of the feathers bordered with cinnamon-rufous increasing in extent from a narrow margin on the outer primary to about one-third the width of the inner web of the secondaries; inner wing-quills narrowly margined externally, and slightly tipped with whitish; median and greater coverts fuscous tipped with grayish; under wing-coverts and axillars ochraceous-buff; sides of the head and underparts gray, paler than the back, chin lighter, throat-patch, center of abdomen, and flanks buff, under tail-coverts ochraceous-buff; bill and feet black, the mandible slightly brownish basally; "eyes red." Wing, 78; tail, 68; tarsus, 16.5; middle-toe and claw, 14; culmen, 12; bill from nostril, 9; height at nostril, 4.5; width at nostril, 5; gonys, 7 mm.

Remarks.— Of this interesting bird we have but a single specimen, labeled as "male, testes enlarged," and the incised primaries evidence the correctness of the collector's determination of the sex of the specimen. Were there reason to doubt this determination we might believe that the bird was related to *Knipolegus aterrimus*, to the female of which it bears some general resemblance, particularly in the cinnamon-rufous of the tail. *K. atterimus*, however, has a much more rounded wing, while the wing in *K. columbianus* is as pointed as in *K. comatus*, from which, however, it differs in its primary formula, its more rounded bill, less rounded tail, absence of a pronounced crest, etc. In short, I strongly suspect that the bird here described represents a new generic type which I refrain from characterizing at present with the hope of receiving additional material.

Muscisaxicola alpina columbiana subsp. nov.

Char. subsp.— Similar to *Muscisaxicola alpina alpina* (Jard.) but averaging slightly smaller, the upperparts darker, more fuscous, the breast grayer.

Type.— No. 112199, Am. Mus. Nat. Hist., ♂ ad., Paramo of Santa Isabel, alt. 12,700 ft., Central Andes, Colombia, Sept. 20, 1911; A. A. Allen; L. E. Miller.

Remarks.— This form, which is apparently the first representative of its genus to be recorded from Colombia, is based on five specimens collected at the type locality. These birds have been compared with two males collected by S. N. Rhoads on Mt. Pinchincha, Ecuador, essentially the type locality. The latter average: wing, 125; tail, 81; tarsus, 32; culmen, 15 mm. Four male specimens of *columbiana* average: Wing, 122; tail, 80; tarsus, 32; culmen, 14.5 mm.

Myiodynastes chrysocephalus intermedius subsp. nov.

Char. subsp.— Similar to *Myiodynastes chrysocephalus minor* Tacz & Berl. but averaging slightly larger and with the underparts less distinctly streaked.

Type.— No. 70845, Am. Mus. Nat. Hist. ♂ ad., Las Nubes, alt. 5000 ft., Sierra Nevada of Santa Marta, Colombia, December 8, 1898, Mrs. H. H. Smith.

Remarks.— The material examined in the present connection includes three specimens of true *chrysocephalus* from Marcapata and Inca Mine, Peru, four essentially topotypical specimens of *minor* from Chimbo, Ecuador, ten specimens from the mountains about the Cauca Valley, which agree with *minor* in color but are slightly larger, ten specimens of *intermedius* from the Santa Marta region and a single specimen from Montaña del Guacharo, Eastern Venezuela which is apparently to be referred to *intermedius*.

The Ecuadorian form, *M. c. minor*, proves to be a well-marked race which may be readily distinguished from *M. c. chrysocephalus* not only by its smaller size (see appended measurements) but by its more streaked underparts and the much greater amount of rufous on the wings and tail. In *minor* the wing-quills are strongly margined with cinnamon-rufous on both inner and outer webs, and, as a rule, only the inner one or two tertials are margined with yellowish and the inner margins of the webs of the tail-feathers are pronouncedly cinnamon-rufous. In *chrysocephalus* the areas which are cinnamon-rufous in *minor* are much more restricted or are buffy, while the yellowish margins, which are wider, appear on all the tertials, and the lores and post-ocular region are less strongly black. In the coloration of these parts *chrysocephalus* more nearly resembles the Central American *M. c. hemichrysus* than it does the intervening *minor* but the latter is smaller and yellower below.

The form here described partakes of both the characters of *minor* and *chrysocephalus* since in the comparatively unstreaked underparts it agrees with the former and in its strong cinnamon-rufous markings with the latter, while in size it is between the two.

Measurements.

		Wing	Tail	Culmen
M. c. chrysocephalus	1 male	108	94	21 mm.
" " "	2 females	106	93	21.5
M. c. minor	3 males	96	81	21
M. c. intermedius	3 males	100	85	21.5
" " "	3 females	98	81	21

Tyranniscus chrysops minimus subsp. nov.

Tyranniscus chrysops (nec Sclater) Salv. & Godm., Ibis, 1880, 124; Bangs, Proc. Biol. Soc. Wash., XII, 1898, 175; Allen, Bull. Amer. Mus. Nat. Hist., XIII, 1900, 148.

Char. subsp.— Similar to *Tyranniscus chrysops chrysops* (Scl.) but very much smaller.

Type.— No. 72740, Am. Mus. Nat. Hist., Minca, alt. 2000 ft., Sierra Nevada of Santa Marta, Colombia, Aug. 4, 1879; G. H. Hull. Wing, 43; tail, 37; tarsus, 13; culmen, 7.

Remarks.— The remarkable variation in size shown by *Tyranniscus vilissimus* is apparently equalled in *T. chrysops.* Lack of properly sexed specimens prevents this from being fully demonstrated, but the material at hand is quite sufficient to show the existence of two well-marked forms.

The range of sexual variation may be learned from the collections lately made in the Western Andes above Cali. Thus six males average, wing, 56; tail, 47 mm., while three females average wing, 50; tail, 43 mm.

As compared with this, four unsexed specimens from Minca in the Santa Marta Region, measure as follows:

Wing, 43	Tail, 37
" 44	" 37
" 45	" 37
" 48	" 39

Doubtless the largest of these birds is a male and the remaining three are females, but without regard to sex the largest Santa Marta specimen is smaller than the smallest Cauca specimen. The difference in size is not well expressed by these measurements, and on comparison of specimens the Santa Marta bird appears to be about one half the size of that from the Cauca. Two unsexed specimens from Ecuador and four from the Bogota region measure as follows:

Ecuador,	Wing, 53	Tail, 44
"	" 52	" 44
Bogota	" 52	" 48
"	" 53	" 47
"	" 56	" 48
"	" 55	" 51

It is thus evident that the name *Tyranniscus chrysops chrysops* (Scl.) (type locality, Gualaquiza, Ecuador) should be applied to the large form of this group, and that this name also covers *Tyranniscus flavifrons* Cab. and Hein., which agrees in size with Bogota specimens and the locality of which — "New Grenada" — may indeed doubtless be interpreted as the Bogotá region.

Tyranniscus nigricapillus flavimentum subsp. nov.

Tyranniscus nigricapillus (nec Lafresnaye) Bangs, Proc. Biol. Soc. Wash., XIII, 1899, 98; Allen, Bull. Am. Mus. Nat. Hist., XIII 1900, 148.

Char. subsp.— Similar to *Tyranniscus nigricapillus nigricapillus* (Lafr.) but superciliary, its frontal extension, and chin yellow instead of grayish.

Type.— No. 72743, Am. Mus. Nat. Hist., ♂ ad., San Lorenzo, alt. 7500 ft., Sierra Nevada of Santa Marta, Colombia, May 12, 1899; G. H. Hull.

Remarks.— In addition to four specimens from the Santa Marta Mountains our collection contains two examples of this form from Escorial near Merida, Venezuela, showing that it is not strictly a Santa Marta form. These six specimens agree closely with each other, and differ as above indicated from five specimens of *T. n. nigricapillus* from "Bogota," the type locality of this race.

A single specimen in our Cauca collections, from an altitude of 10,340 in the Coast Range west of Popayan, has the crown blacker, the back darker and the margins to the secondaries greener than in true *nigricapillus*.

Platypsaris homochrous canescens subsp. nov.

Hadrostomus homochrous (nec Scl.) ALLEN, Bull. Am. Mus. Nat. Hist., xiii, 1900, p. 154.

Char. subsp.— Similar to *Platypsaris homochrous homochrous* (Scl.) but crown dull black instead of shining jet black, back gray instead of black, tail and wing-quills fuscous margined with gray instead of black with little or gray margin, the underparts gray No. 9 rather than gray No. 6, of Ridgway.

Type.— No. 71018, Am. Mus. Nat. Hist. ♂ ad., Cagualito, alt. 1500 ft., Santa Marta Mts., Colombia, May 12, 1898; Mrs. H. H. Smith.

Remarks.— An adult male of *Platypsaris homochrous* from Nóvita, which, according to Hellmayr, represents true *homochrous* (P. Z. S., 1911, p. 1143) shows that a Santa Marta specimen heretofore referred to that form constitutes a well-marked race. An adult male from Panama appears to be slightly darker than the form here described from which it may be separable as a third race. A female from Bonda, Santa Marta, is in too worn plumage to be of value in comparison.

Attila fuscicauda sp. nov.

Char. sp.— Below most nearly resembling *Attila citreopygus* Scl., but breast somewhat deeper colored, above most like *Attila wighti* Cherrie, but green darker, yellow paler and tail without rufous.

Type.— No. 109850, Am. Mus. Nat. Hist., ♂ ad., Gallera, alt. 5700 ft., Andes west of Popayan, June 29, 1911; W. B. Richardson; L. E. Miller.

Description of male.— Upperparts dark olive-green without rufous tinge; crown with dusky shaft streaks and anteriorly with greenish yellow margins; rump and upper tail-coverts canary yellow; tail fuscous, lightly margined externally with olive-green; wings nearly black, secondaries and coverts margined with olive-green, somewhat paler on the latter; throat and breast of the general color of the upperparts, streaked with dusky and margined with greenish yellow; flanks yellow streaked or washed with olive-green, center of the belly whitish, under tail-coverts lemon yellow. Wing, 88; tail, 71; tarsus, 20; culmen, 21.5 m.

Description of female adult.— Resembling the male but tail somewhat brown and with a faint trace of rufous basally. Wing, 85; tail, 65; tarsus, 21; culmen, 20 mm.

Remarks.— It is possible that this bird may be shown later to intergrade with *Attila wighti*, of which Mr. W. E. C. Todd has loaned me two specimens from eastern Venezuela which he has compared with the type of *wighti*. Aside, however, from the differences in their upperparts already referred to, *A. fuscicauda* has much less white below and the under tail-coverts are distinctly yellow. On the other hand *fuscicauda* may be the southern form of *A. c. citreopygus*, though this seems hardly probable. [illegible] ships have been ascertained it seems desirable to accord it

Rupicola peruviana aurea subsp. nov.

Char. subsp.— Similar to ***Rupicola peruviana peruviana*** Lath., but male with the anterior parts of the body and particularly the crest, more orange in color, orange-chrome rather than flame-scarlet, the gray of the tertials more restricted not wholly concealing the subapical black of the underlying feather; general coloration of female more orange.

Type.— No. 112429. Am. Mus. Nat. Hist., ♂ ad., Salento, alt. 7000 ft., Central Andes, Cauca, Colombia, October 1, 1911; A. A. Allen; L. E. Miller.

Remarks.— This form is based on two adult males and two adult females, taken at the type locality in September and October. Of *R. p. peruviana* our collection contains three males and two females taken by Keays at Inca Mine, Peru, in 1899 and 1900, and of *R. p.* "*saturata*" one male taken by Garlepp at Locotal, Bolivia, in 1891.

In addition to this authentic material we have trade specimens of *peruviana* from Ecuador and 'Bogota,' which are decidedly more orange than the bird here described and which possibly may constitute a recognizable form (cf. Tacz. and Berl. P. Z. S., 1885, p. 93). Fresh material, however, will be required satisfactorily to determine whether the characters presented by these specimens from Ecuador and the Eastern Andes of Colombia are actual or due to fading. In the meantime, however, we are fully justified in separating this form from the North Central Andes.

Phæoprogne tapera immaculata subsp. nov.

Progne tapera (nec Gmel.) Baird, Rev. Am. Birds, I, 286.

Char. subsp.— Similar to *Phæoprogne tapera tapera* (Gmel.) but underparts without the median line of spots which reach from breast to belly in that species; the pectoral band generally more pronounced.

Type.— No. 112459, Am Mus. Nat. Hist., ♂ ad., Chicoral (near Giradot), alt. 1800 ft., Tolima, Colombia, October 6, 1911; A. A. Allen; L. E. Miller.

Remarks.— The two forms of this genus were clearly defined by Baird (*l. c.*) who, however, employed the name *fusca* Vieill. for the bird with the centrally spotted underparts to which the older name *tapera* also seems applicable. Accepting the dictum of von Berlepsch and Hartert [1] as definitely establishing Brazil for the type locality of *tapera* this name may be considered to cover the southern form of the species and to include *fusca* as a pure synonym. If this view of the case be correct the northern form, with the unspotted belly, may be known under the above given title.

That there are two well-marked races, possibly species, of this dull-colored, comparatively square-tailed Martin, seems but little open to doubt. Of the bird to which I assume the name *tapera* is applicable, I have eleven specimens from Matto Grosso, Brazil, taken in the months of January, February, April, September, October, November, and December, and all have a well-defined line of large fuscous spots extending from the center of the breast to the belly.

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[1] Nov. Zool., IX, 1902, p. 14.

Of *immaculata* I have three specimens taken at Chicoral in October, one from Bogotá, and nine taken at Maripa and Suapure, Venezuela, in March, April, May, and December. Only two of these birds show any indication of spots below; the Bogotá bird, which is immature, has a faint dusky streak on the lower breast, and a female, taken at Suapure, April 27, has a number of spots on the lower breast immediately adjoining the pectoral collar. These spots do not reach to the abdomen, nor do they appear to be restricted to the median line, but extend across the breast. This bird has an unusually well-marked and sharply defined pectoral color, a character which is more pronounced in the northern than in the southern form. In none of the remaining eleven specimens of *immaculata* are median pectoral spots visible. This character appears therefore to be racially diagnostic and to warrant the recognition of two forms of this genus.

Troglodytes solstitialis pallidipectus subsp. nov.

Char. subsp.— Similar in size to *Troglodytes solstitialis solstitialis* Scl., more closely agreeing in color with *T. s. macrourus* Berl. & Stolz., much less rufescent throughout than *T. s. solstitialis* the breast being but slightly, instead of strongly washed with buff; wings, tail, and bill shorter than in *T. s macrourus*, the upperparts less cinnamoneus.

Type.— No. 109902, Am. Mus. Nat. Hist., ♂ ad., Cerro Munchique, alt. 8300 ft., Andes west of Popayan, Cauca, Colombia, June 1, 1911; W. B. Richardson; L. E. Miller. Wing, 46; tail, 31; tarsus, 16.5; culmen, 10 mm.

Remarks.— Three specimens of *pallidipectus* from the type locality, and nineteen from Laguneta and Santa Isabel, two of *T. s. solstitialis* (type locality, Riobamba, Ecuador) from Ambato and two from "Guayaquil," and topotypes of *T. s. macrourus* and of *T. s. frater* have been examined in the present connection. September and October specimens of *pallidipectus* are more richly colored but none has the breast as heavily washed with buff as in *solstitialis*.

Thryophilus nigricapillus connectens subsp. nov.

Char. subsp.— Agreeing with *Thryophilus nigricapillus schotti* (Baird) in the coloration of the underparts, but throat white, the breast less heavily barred; throat as in *T. n. nigricapillus* but rest of the underparts more heavily barred, and the back much richer ferruginous than in that form

Type.— No. 109894, Am. Mus. Nat. Hist., ♂ ad., Cocal, alt. 5000 ft., Andes west of Popayan, Cauca, Colombia, June 10, 1911; W. B. Richardson; L. E Miller.

Remarks.— Although one of the less strongly marked, this is one of the most interesting forms we have thus far received from the Cauca Region since it clearly shows how decrease in intensity of color follows decrease in rainfall. Thirteen examples from the coast at Buenaventura and San José have the uniformly barred underparts of *T. n. schotti* (type locality Atrato River), while seven, including the type, from an altitude of 4000 feet on the eastern slope of the Andes, evidently reflect in their lighter colors the results of the lower humidity prevailing at that altitude.

Of *T. n. nigricapillus* (type locality, Nanegal, Ecuador) I have two specimens from "Quito."

Cinnicerthia olivascens infasciata subsp. nov.

Char. subsp.— Similar to *Cinnicerthia olivacens olivascens* Sharpe but larger, bill and tarsus heavier, upperparts less rufescent, and practically unbarred.

Type.— No. 109887, Am. Mus. Nat. Hist., ♂ ad., Andes west of Popayan, alt. 10340 ft , July 18, 1911; W. B. Richardson; L. E. Miller. Wing, 73; tail, 73; tarsus, 27; culmen, 15 mm.

Remarks.— This form may deserve specific rank but a faint trace of barring on the backs of two of our seven specimens suggests the possibility of intergradation with *C. o. olivascens* (of which I have examined two specimens, one from Antioquia, the type locality, having recently been presented to the Museum by Señor Francisco Escobar, Colombian Consul-General at New York) as the range of the latter is approached.

The white frontal patch, shown on the specimen figured in the British Museum 'Catalogue of Birds' (Vol. VI, pl. xi) is evidently a purely individual character. It is as well developed in one of our specimens as in the one just mentioned, in three others it is barely evident, and in the remaining three it is absent.

Planesticus fuscobrunneus sp. nov.

Char. subsp.— Related to *Planesticus atrosericeus* (Lafr.) and *P. serrana* (Tschudi); agreeing in size with the former, slightly larger than the latter; male similar in color to males of *atrosericeus* and *serrana*, female nearer female of *atrosericeus* but much darker.

Type.— No. 109923, Am. Mus. Nat. Hist., ♀ ad., Cerro Munichique, alt. 8325 ft., western Andes, west of Popayan, Cauca, Colombia, May 27, 1911; W. B. Richardson.

Description of Female.— Upperparts nearly uniform olivaceous clove-brown; tail and wings darker, the former margined with the color of the back, the latter externally margined with dark mars-brown; underparts but slightly paler than upperparts, the throat indistinctly streaked with blackish; under wing-coverts like abdomen but faintly washed with cinnamon; bill and feet brownish-yellow. Wing, 121; tail, 107; tarsus, 32; exposed culmen, 19.3. Five males from the same general locality average; wing, 124; tail, 108; tarsus, 34; exposed culmen, 22.5 mm.

Remarks.— While this Thrush presumably represents *Planesticus atrosericeus* or *P. serrana*, it is not sufficiently close to either to permit of its description as a subspecies. Although geographically intermediate between the two, it presents an extreme of coloration being in some respects less closely related to *atrosericeus* and *serrana* than they are to one another.

In addition to three males and two females from the type locality, the collection contains a pair of birds from La Florida in the same range, and two males and a female from San Antonio (alt. 6600 ft.) in the western Andes immediately above Cali. The last-named female is darker and more rusty below than the Munchique birds and has pronounced black throat streaks.

For comparison with this material I have had six males and two females of *P. atrosericeus* (type locality Caracas) from Merida, and a female (Carnegie Mus.) from Guarico, Estado Lara, Venezuela, and one male and two females of *P. serrana* from Inca Mine, Peru.

Vireosylva chivi caucæ subsp. nov.

Char. subsp.— Differing from *Vireo chivi chivi* (Vieill.), as represented by a series of twenty-two specimens from Chapada, Matto Grosso, in being slightly darker, more olive-green above, with the crown deeper more slaty, the superciliary whiter, the auricular region more olive-gray, less yellow; differing from *V. c. agilis* (Licht.), as represented by a large series from eastern Venezuela, Trinidad, and Santa Marta, Colombia, in being much darker above, olive-green rather than yellow-green, with the auricular region averaging more olive-gray, less yellow. Male, wing, 70; tail, 52; tarsus, 17; culmen, 12 mm. Female, wing, 66; tail, 48; tarsus, 17; culmen, 12 mm.

Type.— No. 109126, Am. Mus. Nat. Hist., ♂ ad. (testes slightly enlarged), Cali, Cauca, Colombia, May 10, 1911; F. M. Chapman; W. B. Richardson.

Remarks.— I find it impossible to refer nine Vireos from the Cauca Valley and adjoining mountains to any of the recognized forms of this group, and see no alternative other than to designate them as above. They all closely show the characters on which this proposed form is based and apparently constitute a well-marked race of this wide-ranging species.

Vireosylva chivi griseobarbata Berl. & Tacz.[1] from Chimbo, Ecuador, might be expected to agree with the Cauca form, but it is described as having gray mystacal streaks, and the breast washed or flammulated with gray, characters shown by no specimen in my very large series of *Vireosylva chivi.*

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[1] P. Z. S., 1883, p. 541.

Basileuterus richardsoni sp. nov.

Char. sp.— Most closely related to *Basileuterus luteoviridis* (Bp.) but upperparts dark olive-green instead of bright yellowish olive-green underparts much paler, superciliary whitish, instead of yellow.

Type.— 109971, Am. Mus. Nat. Hist., ♂ ad., western Andes, west of Popayan, alt. 10,340 ft., July 16, 1911; W. B. Richardson.

Description of Male.— Upperparts uniform dark olive-green, external margins of rectrices and remiges yellowish; superciliaries whitish, underparts dusky olive-green, brighter medianly, more olive on the sides and flanks. Wing, 69; tail, 63.5; tarsus, 20.5; culmen, 10 mm. (average two specimens).

Description of Female.— Similar to the male but smaller and more dusky below. Wing, 61; tail, 57.5; tarsus, 20; culmen, 10 mm. (average two specimens).

Remarks.— Of this well-marked species the collection contains seven specimens from the type locality and one from Laguneta in the Central Andes. Of true *luteoviridis* from Bogotá we have two specimens, while one from Yungas, Bolivia, and two from Inca Mine, Peru, while nearly agreeing with the Bogotá specimens in color, are much smaller; their wing measurements being, male, 59; female, 55 mm.

I have named this species in honor of its collector, who, for the past twenty-five years, has through his field work been adding to the store of neotropical birds contained in Museums.

Spinus nigricauda sp. nov.

Char. sp. - Most nearly resembling *Spinus spinescens capitaneus* Bangs but with longer wings, darker back, no yellow at the base of the tail, less yellow in the wing and heavily streaked under tail-coverts, etc.

Type. No. 112752, Am. Mus. Nat. Hist., ♂ ad., Paramo, Santa Isabel, alt. 12700 ft., Central Andes, Colombia, Sept. 15, 1911; A. A. Allen; L. E. Miller.

Description of Male.— Back olive-green bordered with oil-green, hind neck, particularly at the sides, paler, crown-cap and lores jet-black, auriculars and sides of the head olivaceous yellow; rump greenish yellow, upper tail-coverts black bordered by oil-green; tail-feathers black to the base, except the outer pair which show a trace of yellow at the extreme base of the inner web, outer webs margined with oil-green decreasing in extent outwardly and absent on the outer pair of feathers; wings black, crossed by a broad basal yellow band much brighter in color on the outer than on the inner webs of the feathers, and barely evident on the inner vane of the outer two or three primaries; primary coverts black, lesser and greater coverts black, tipped with oil-green which on the greater coverts is restricted to the outer web; underparts dusky olivaceous yellow, under tail-coverts the same, the longer one streaked medianly with black and black basally.

Remarks.— While this form, which is based on two adult males is presumably a representative of *Spinus spinescens*, it appears to have developed characters warranting its recognition as a species. For comparison I have eight Bogotá (type locality) specimens of *S. s. spinescens*, and ten Santa Marta specimens, including the type, of *S. s. capitaneus*, loaned me by Mr. Bangs. Aside from its larger bill *capitaneus* appears to be more dusky or olivaceous below than *spinescens* and in this respect it more nearly approaches *nigricauda*. Measurements of males of the three forms are appended:

	Wing	Tail	Ex. culmen	Depth of bill at base
S. nigricauda,	73	45	11	6.5
Paramo of Santa Isabel	72	43	11	7.
S. s. capitaneus,	65	43	10	7.2
San Miguel, Col.	66	44	11.7	7.2
	65	43	10.7	7.
	67	44	10.7	7.
	69	44	10.3	7.
S. s. spinescens,	65	43	10.	5.5
'Bogota'	67	43	9.5	6.
	65	43	10.	5.5

Ammodramus savannarum caucæ subsp. nov.

Char. subsp.— Similar to *Ammodramus s. australis* but darker, black central areas to feathers larger, chestnut areas smaller and darker, edging to feathers grayer, less buffy.

Type.— No. 110005, Am. Mus. Nat. Hist., ♂ ad., Cali, Cauca, Colombia, August 11, 1911; W. B. Richardson; L. E. Miller. Wing, 60; tail, 47; tarsus, 18; culmen, 12 mm.

Remarks.— The extension of the breeding range of the Yellow-winged Sparrow to the South American continent is one of the most interesting discoveries of our Colombian expedition. In addition to the type the collection contains two males taken at Cali, December 25 and 29, respectively. Both had the testes enlarged and are in slightly worn breeding plumage. In the type what is evidently the postnuptial molt is in progress on the anterior parts of the body and lesser wing-coverts. This material, while evidently representing a resident and not migrant form, would be more satisfactory if it contained specimens in fresh plumage. It is apparent, however, from the newly grown feathers on the type as well as from the plumage of the two December birds, that this race is characterized by the large, black, dark chestnut areas, and gray margins of the feathers of the upper surface of the body, and paleness of the underparts, the flanks having much less buff than in any other form of the species.

The Cauca bird appears most closely to resemble *A. s. obscurus* Nels. of southern Mexico, but it is generally paler with the grayish margins wider, the chest is paler, and the flanks have less, or almost wholly lack the buff wash.

Myospiza manimbe columbiana subsp. nov.

Char. subsp.— Upperparts much darker and more broadly streaked than in *Myospiza manimbe manimbe* (Licht.), the crown and back of about the same color.

Type.— No. 108446, Am. Mus. Nat Hist., ♂ ad., Cali, Cauca, Colombia, December 27, 1910; W. B. Richardson; L. E. Miller. Wing, 55; tail, 51; tarsus, 18; culmen, 12 mm.

Remarks.— *Myospiza manimbe manimbe* is represented in our collections by two specimens from Bahia, Brazil (the type locality) and twenty-five from Chapada, Matto Grosso, which agree closely with the type form. This excellent series shows that in fresh plumage true *manimbe* has the crown and back conspicuously different in color, the former, with the nape, being black narrowly margined with chestnut which is widely bordered with gray, while in the back the black and gray areas are reduced, the chestnut increased, giving the bird, to some extent, the appearance of being gray-headed and brown-backed.

In *columbiana* the back and crown are of essentially the same color. The head has little or no chestnut and the gray margins are not so conspicuous as in *A. m. manimbe,* while the black areas occupy the larger part of the feather, and their reduced chestnut margins are distinctly different from the corresponding rusty areas in *manimbe.* From Cali we have five specimens of this well-marked form to which I should also refer a freshly plumaged bird from near Honda, Tolima. Specimens from Chicoral, however, are paler and more nearly resemble others from Venezuela, which with examples from Bogotá and Santa Marta, appear to be intermediate between true *manimbe* and *columbiana.* A study of adequate material of this wide-ranging species will, doubtless, result in the recognition of a number of additional forms.

Atlapetes flaviceps sp. nov.

Char. sp.— An apparently very distinct species not closely related to any described form of the genus; head and underparts yellow, back, wings, and tail olive-green.

Type.— No. 112816, Am. Mus. Nat. Hist., Rio Toché, alt. 6800 ft., Quindio Trail, Central Andes, ♂, Oct. 24, 1911; A. A. Allen; L. E. Miller.

Description of Type.— Crown chrome-yellow with an olivaceous tinge, a dull olive-green postocular streak joining its fellow on the hind-neck, sides of the head chrome-yellow extending to a narrow nuchal collar; back, rump and upper tail-coverts dark olive-green; tail, strongly graduated, fuscous, all but the outer pair of feathers externally margined with olive-green; wings and their coverts fuscous margined externally with olive-green, the outer webs of the outer primary whitish, the inner margins of the inner webs of all the wing-quills white, increased in extent from the outer primary inwardly; underparts rich chrome-yellow, sides, flanks, thighs, crissum, and under tail-coverts olivaceous; feet and bill brownish black. Wing, 27; tail, lateral feather, 65; central feather, 82; tarsus, 34; culmen, 14; depth of bill at nostril, 7.5 mm.

Remarks.— The second of the two specimens of this apparently well-marked species, was taken at the type locality October 25, and is labeled " ♀, *juv.*" It resembles the type but has the crown and sides of the head largely olive-green in which appear a few yellow feathers, suggesting that the olive-green areas occupying the postocular and nuchal regions in the type are indications of immaturity and that in fully mature plumage the whole crown and nape are yellow.

Atlapetes flaviceps has the tail more strongly graduated than any species of the genus known to me while the bill is almost as stout as in *A. gutturalis.*

Cyanocompsa cyanea caucæ subsp. nov.

Char. subsp.— Similar to *Cyanocompsa cyanea cyanea* (Linn.) but base of maxilla more inflated laterally, azure frontal band in male narrower, female decidedly paler, the general tone of the back being cinnamon wood-brown rather than russet mars-brown, of the rump and underparts, cinnamon rather than russet.

Type.— No. 109175, Am. Mus. Nat. Hist., ♂ ad., La Manuelita near Palmira, alt. 3500 ft., Cauca Valley, Colombia, April 14, 1911; F. M. Chapman; W. B. Richardson.

Remarks.— In addition to the type we have a female topotype, two adults and one immature male and two females from Caldas in the western extension of the Valley Zone on the Pacific slope of the Western Andes. For comparison with these seven specimens I have three topotypes of *C. c. cyanea* from Bahia (an adult male and two birds in female plumage having a few blue feathers about the head), an adult male and female from the Parana River, two females from Maclio and San Paulo, Brazil, and an adult male from San Antonio, northern Venezuela. This last-named bird, which I assume represents *C. c. minor* (Cab.), agrees in size with males from the Cauca and the adult male from Bahia, but has the azure frontal band more prominent than in either, and it extends backward as pronounced superciliaries. In the shape of the bill this specimen agrees with true *cyanea* rather than with *caucæ,* but the maxilla shows a slight approach toward the bulbous, inflated condition which so strongly characterizes the latter. So far as *cyanea* is concerned the form here described is clearly separable, but in the absence of females of the Venezuela bird I am unable to determine its exact relationships to *minor*, assuming this form to be worthy of recognition.

I fully agree with Hellmayr (Nov. Zool., XII, 1905, p. 277) that *Cyanocompsa rothschildi* is a representative of the *cyanoides* rather than of the *cyanea* group, indeed the differences between the two groups, which are shown chiefly in the character of the bill and coloration of the female, impress me as being of at least subgeneric value. (On this point see Ridgway, Bull. 50, I, U. S. Nat. Mus., p. 594). While representatives of the two groups are found in the same general locality I believe that *cyanea*, like its northern congener *parallina*, will be found to inhabit open scrubby growths or savannas, while *cyanoides* is a bird of the forests.

Measurements.

		Wing	Tail	Culmen
Bahia, Brazil	[♂ im.]	71	66	15
" "	[♂ im.]	71	66	15
" "	[♂]	75	69	15
San Antonia, Venezuela	♂	75	65	15.5
Cauca, Colombia	♂	73	66	15
" "	♂	75	69	15
" "	♀	70	64	15
" "	♀	70	64	15

Diglossa cryptorhis sp. nov.

Char. sp.— Mostly closely related to *Diglossa indigotica* Scl. of Ecuador but nostrils more concealed, plumage of a different texture, firmer, more glossy and of a brighter color; tail shorter.

Type.— No. 110091, Am Mus. Nat. Hist., ♀ ad., Gallera, alt. 5700 ft., Andes west of Popayan, Cauca, Colombia, July 2, 1911; W. B. Richardson; L. E. Miller.

Description of Type.— Uniform dark blue, nearest Berlin blue of Ridgway's Plate IX; upper and under tail-coverts and lower abdomen somewhat less intense and nearer the shade of the exposed blue margins of the black wings and tail; lores and feathers at the base of the lower mandible black. Wing, 61; tail, 37; tarsus, 18; culmen, 11 mm.

Remarks.— This species is so unlike its nearest known relative in its nearly concealed nostrils, firm, shining plumage, and proportions of tail to wing as to suggest the possibility of an even greater than specific distinctness. In addition to the type the collection contains one adult male, collected by Allen and Miller, December 12, 1911, at an altitude of 7200 ft. on the trail between Cartago and Nóvita, which agrees with it in color.

Diglossa gloriosissima sp. nov.

Char. sp.— Most closely related to *Diglossa gloriosa* Scl. & Salv., but much larger, black areas less sooty, lesser wing-coverts and rump bluer, rufous of underparts brighter, thighs black, no superciliary line.

Type.— No. 110078, Am. Mus. Nat. Hist., ♂ ad., Andes, west of Popayan, alt. 10,340 ft., July 18, 1911; W. B. Richardson; L. E. Miller.

Description of Male.— Upperparts, wings, tail, throat and breast shining black; lesser wing-coverts bluish gray of the same shade as in *D. lafresnayi*, a faint wash of the same color on the rump; no superciliary line; lower breast and abdomen bright cinnamon-rufous; thighs, sides, mainly under the wings, and center of some under tail-coverts black; bill black. Wing, 75; tail, 65; culmen, 12 mm. (average of four specimens).

Description of Female.— Similar to the male, but rump with more bluish gray, thighs slightly grayer. Wing, 70; tail, 62; culmen, 11.5 mm.

Description of Juvenal.— Similar to the adult but black areas duller, lesser wing-coverts and rump black; rufous of underparts more or less marked with black due to shaft-streaks and to exposed blackish bases of feathers; lower mandible yellow, except at tip.

Remarks.— This well-marked representative of *Diglossa gloriosa* is represented by ten specimens, five adult males, one adult female, and four young, all from the type locality. For comparison with this series I have an adult female of *gloriosa*, from Merida, Venezuela, the type locality. It measures, wing, 60; tail, 52; culmen, 9.5 mm.

Sporathraupis cyanocephala margaritæ subsp. nov.

Tanagra cyanocephala auricrissa (nec Sclater) ALLEN, Bull. Am. Mus. Nat. Hist., XIII, 1900, 168.

Char. subsp.— Similar to *Sporathraupis cyanocephala auricrissa* (Scl.) but somewhat smaller, the olive-green areas suffused with orange, the throat and breast heavily washed with the blue color of the head, the rest of the underparts slightly darker.

Type.— No. 72469, Am. Mus. Nat. Hist., ♂ ad., Valparaiso, alt. 5000 ft., Sierra Nevada of Santa Marta, Colombia, April 1, 1899; Mrs. H. H. Smith. Wing, 84; tail, 70; tarsus, 19; culmen, 18 mm.

Remarks.— This bird is represented by only two specimens but its characters are so pronounced and I have so satisfactory a series (30 specimens) representing all the other forms of the species that I have no doubt of its validity.

I take especial pleasure in dedicating this, the most strongly characterized race of its group, to its collector Mrs. Herbert H. Smith, whose work in Brazil, Mexico, and Colombia has added so greatly to our knowledge of the bird-life of tropical America.

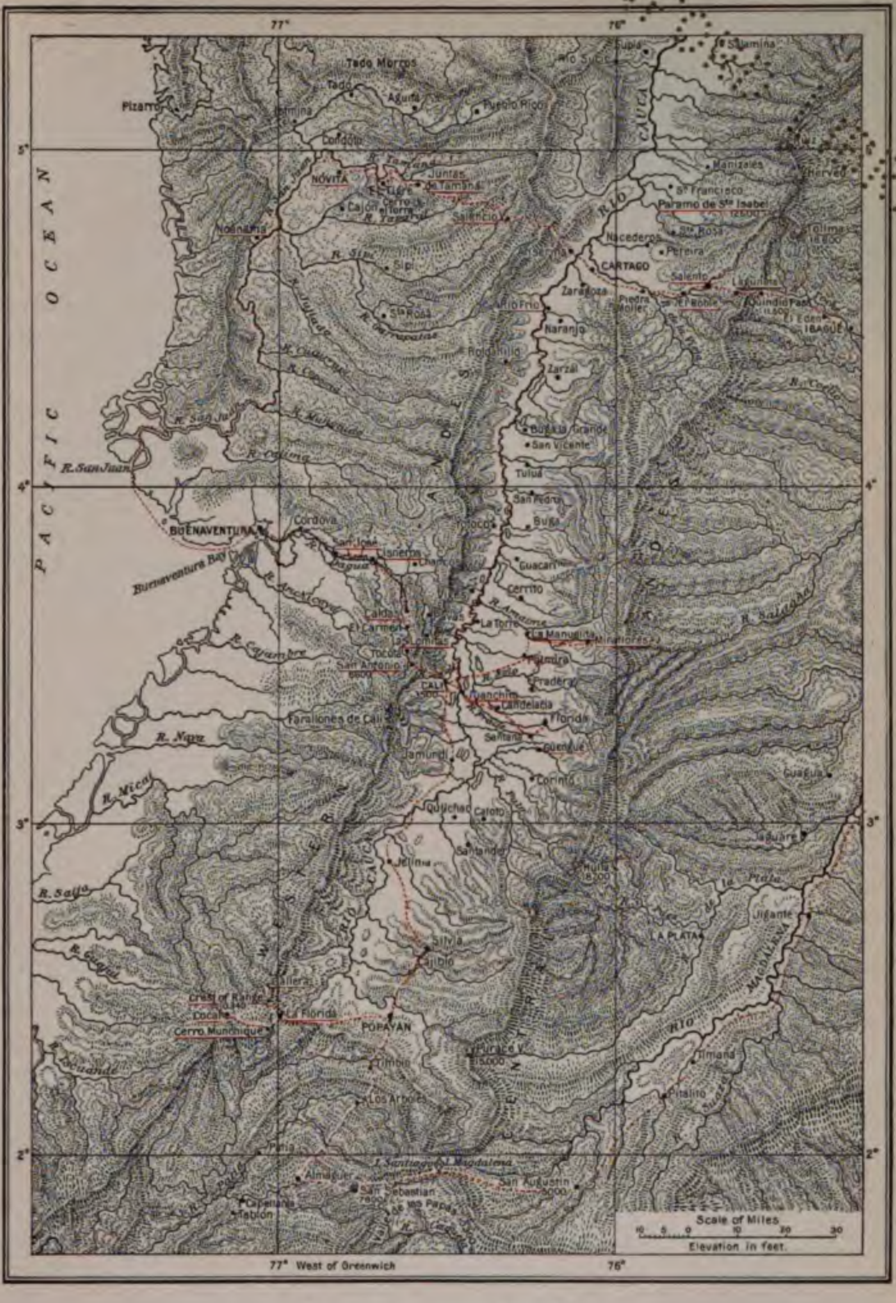
Chlorospingus albitempora nigriceps subsp. nov.

Char. subsp.— Most nearly related to *Chlorospingus albitempora venezuelanus* (Berl.) of Venezuela, but throat paler fulvous and with no postocular mark.

Type.— No. 109326, Am. Mus. Nat. Hist., ad. ♀, Miraflores, alt. 6800 ft., Central Andes, east of Palmira, Cauca, Colombia, April 29, 1911; Frank M. Chapman. Wing, 65; tail, 60; tarsus, 19; culmen, 11 mm.

Remarks.— In addition to the type Mr. Fuertes secured a male (coll. L. A. F:, No. 2398) at the same locality, while Allen and Miller secured specimens in the Central Andes at the following localities: above Salento, alt. 9000 ft., one; Rio Toché, alt., 6800 ft., four; El Eden above Ibague, alt. 8300 ft., two. The form therefore occurs on both slopes of the Central range.

Although in color this bird is separated from its nearest ally only by the absence of the white postocular mark, the facts in regard to its distribution strongly suggest its specific distinctness, the range of *albitempora* extending from Bolivia to Costa Rica and Venezuela. Our collection contains specimens from all these regions but none is without the postocular mark.



MAP OF WESTERN COLOMBIA.

(Drawn by F. Müller under the direction of Frank M. Chapman.)

Dotted red line indicates route of the Museum's expedition. Collections were made at localities underlined in red.

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Article XVII.— BRACHYOSTRACON, A NEW GENUS OF GLYPTODONTS FROM MEXICO.

By Barnum Brown.

Plates XIII–XVIII.

While travelling in Mexico in 1910 the writer examined a deposit of early Pleistocene? age fairly rich in vertebrate remains near the town of Ameca in the state of Jalisco.

The Ameca River valley at this point is enclosed by moderately high mountains at the base of which, on either side of the river, Post Tertiary sediments are exposed in terraces to a height of two hundred feet.

The escarpments, of limited extent, are composed chiefly of volcanic ash, rhyolitic debris and gravel with an admixture of diatomaceous clay having the appearance of a river sediment. Apparently the outlet of the valley was obstructed during Pleistocene times when a shallow lake was formed over a considerable part of the valley.

Fresh water shells, fish teeth and bones, and turtle shells were found *in situ* in the highest clay strata but vertebrate remains were chiefly found in the gravels. Many of these remains are identifiable only as to families.

Invertebrates.

Valvata and *Amnicola*.

Fish.

Siluroids, spines and jaws.
Cyprinidæ, pharyngeal teeth, vertebræ and bones

Mammals

Sciuridæ, teeth.
Geomyidæ, teeth.
Cricetidæ, jaw.
Machærodont, radius.
Equus, sp. teeth, jaws and separate bones.
Elephas columbi, tooth.
Glyptodont, complete carapace and part of skeleton.

The Glyptodont is of chief interest as it forms a new genus and establishes the position of the Mexican representatives of this order.

During the excavation for a drainage canal in the valley of Mexico in

1869? two nearly complete carapaces of Glyptodonts were found near Tequixquiac one of which is preserved in the National Museum of Natural History, the other in the National School of Engineers in Mexico City.

In 1874 two civil engineers, Señors J. N. Cuatáparo and Santiago Ramirez, described [1] the specimen now in the Museum of Natural History, giving to it the name *Glyptodon mexicanus*. No reference is made to this publication in Hay's 'Bibliography' or in the 'Zoölogical Record,' so far as I can find.

In 1884 Professor E. D. Cope,[2] referred to these specimens as pertaining to a species indeterminate and attributed the first mention to Dr. Mariano Barcena,[3] who simply mentions the specimens and their occurrence with other bones.

In 1903 in an article on the fossil fauna of the valley of Mexico, Dr. Manuel M. Villada[4] mentions the carapace and gives a faulty mechanical drawing of the one in the National Museum collection, a delineation in which the periphery of each plate is round, obviously an incorrect drawing.

The original description of the species (*loc. cit.*) was based on a nearly complete carapace, skull, and sacrum and is accompanied by a restoration. In this restoration the carapace is reversed, end for end, and the delineation is very faulty giving an incorrect reproduction of the sculpturing. The border plates where missing are restored in approximately uniform size and pattern while a solid caudal sheath has been supplied, apparently without existence as it is not mentioned in the description.

The description though meager and insufficient serves to establish the validity of the species.

Through the courtesy of Doctor José G. Aguilera, Director of the Instituto Geologico, I was able to make notes and photograph the carapace of the type specimen in the National Museum of Natural History. I am further indebted to Dr. Aguilera for the accompanying beautiful photographs of this specimen (Plates XIII–XV), which are the first published and introduced here for comparison. Neither skull nor sacrum are exhibited with it at present and I am informed that those parts have been lost.

The original description and these new photographs show at once that it belongs to the genus herein described though a distinct species.

It is distinguished from the following species by the form of the anterior premolars which are more distinctly molariform; central figure of plates larger; transverse rows not continued as far beyond the border and the more firmly united; border plates larger and more pendant.

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[1] Boletin Sociedad de Geografia y Estadistica, Vol. II (3), pp., 354–362, 1875.

[2] Proceedings American Philosophical Society, Vol. XXII, p. 2, 1885.

[3] Revista Cientifica de Mexico, Vol. I, p. 3, 1882.

[4] Anales del Museo Macional de Mexico, Vol. VII, pp. 441–451, 1903.

In the order, Glyptodontia, the pattern of the teeth in the upper series is quite faithfully reproduced in opposing teeth of the lower series.

Where they have become molariform the anterior faces of the upper teeth present a plane at right angles or slightly oblique to the longitudinal axis while the posterior face is curved.

The lower teeth are reversed, with anterior faces curved or obtusely angulate; posterior faces plane or rounded and directed at right angles or oblique to the longitudinal axis according to the position in the series.

The obliquity of the plane face in both upper and lower teeth increases, going forward in the series through molars and premolars.

In the earliest known Glyptodonts, *Propalæohoplophorus,* and allied genera from the Santa Cruz (Miocene), the first premolars are cylinders; second compressed cylindroid; third faintly trilobate; fourth distinctly trilobate and molariform.

In the later genera, *Glyptodon, Panochtus,* and *Sclerocalyptus* (*Hoplophorus*) of the Pampean (Pleistocene) the premolars have all become molariform with trilobate condition of first premolar, most pronounced in the genus *Glyptodon.*

In *Plohophorus* from Monte Hermosa (Pliocene) the first premolar retains the primitive cylindrical form while the second premolar shows tripartite division only on one side.

According to these relations, determined by a comparative study of skulls representing most of the South American genera, I have placed the loose teeth of the following described species in their respective positions checking the location by the length and curve of each tooth. Future discoveries may show that I have confused the position of premolars but the true molars follow in perfect sequence.

Brachyostracon cylindricus gen. et sp. nov.

Type of genus and species: No. 15548, Am. Mus. Coll., a complete carapace, cephalic plates, atlas, hyoids, several ribs, a chevron and 20 separate teeth.

Generic and specific characters. Carapace shorter than wide, outside measurement from border to border. A prominent hump above the sacrum divides the carapace into a short posterior and a long anterior part. Posterior end of carapace back of pelvis short and recurved upward. Anterior end greatly decurved and lower than posterior end. Anterior lateral border of carapace without forward extension. Plates of carapace inside of border with a round central figure surrounded by a single row, composed of from eight to twelve marginal polygonal figures. Border plates pendant. Anterior premolars cylindroid. Vaso-dentine ridges feebly branched. Sacrum and posterior lumbars fused in a long tube composed of sixteen vertebræ.

Teeth.— The teeth of *Brachyostracon cylindricus* in size and length are equal to those of *Glyptodon*. They increase in size from the anterior end of both series up to the fifth. The fifth and sixth are equal and largest. The seventh is smaller than the sixth and the eighth is distinctly smallest of the true molars. The last molar in the lower series is considerably larger than the opposing tooth of the upper series.

A Vaso-dentine ridge within the dentine subdivides with faint ramifications according to the lobation of each tooth.

The teeth preserved are, as I place them, L. $\underline{2}$, $\underline{3}$, $\underline{4}$, $\underline{5}$, $\underline{6}$, $\underline{7}$, $\underline{8}$, R. $\underline{4}$, $\underline{5}$, $\underline{6}$, $\underline{8}$; L. $\overline{5}$, $\overline{6}$, $\overline{7}$, $\overline{8}$, R. $\overline{1}$, $\overline{2}$, $\overline{6}$, $\overline{7}$, $\overline{8}$,

In the serial outlines (Figs. 1 and 2) teeth from the right upper side have been transposed to the left, and from the right lower to the left lower, in order to complete each series as far as possible.

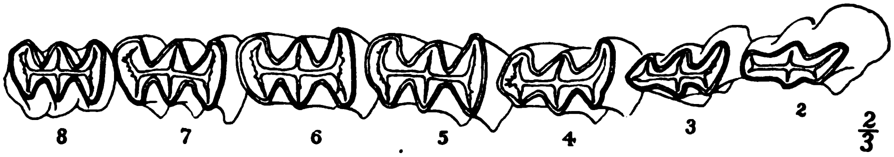

Fig. 1. *Brachyostracon cylindricus.* Left upper series, first molar absent.

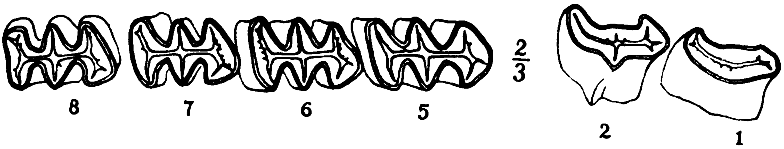

Fig. 2. *Brachyostracon cylindricus.* Left lower series, first and second teeth transposed, third and fourth absent

In the upper series all premolars present are distinctly trilobate but the second and third are considerably smaller than succeeding teeth with outer sulci shallow.

In the lower series the first premolar takes the form of a compressed, elongate cylinder. A shallow sulcus impresses the posterior half of the outer border but the tooth is in no sense lobate.

The second premolar is distinguished by a wide deep sulcus on the outer face and a sharp prismatic column on the inner middle face, flanked on either side by faint sulci, so that in a manner the grinding surface is trilobate on the inner half and bilobate on the outer half.

The last molar is smaller than preceding molars and the posterior face of the last lobe is marked by a faint vertical sulcus.

The above characters at once distinguish this from described species.

They mark a stage of tooth development less progressive than in *Glyptodon*, *Panochtus* or *Sclerocalyptus* (*Hoplophorus*) and comparable to that of *Plohophorus*.

The teeth of *Brachyostracon* (*Glyptodon*) *mexicanus* (*loc. cit.*, pp. 358–59) are all said to be trilobate but with lobation less marked in anterior teeth, a character that distinguishes it from the present species.

The measurements given by Cuatáparo and Ramirez, partly borne out by the projected outline of the skull, are most remarkable. As described this skull differs from the usual Glyptodont form chiefly in extreme elongation of the facial portion, similar to that of *Eutatus*, in the angulation of the lower jaw, and in the position of the teeth in the lower jaw. According to measurements and outline all teeth in the lower jaw are visible from the side whereas in *Glyptodon* only the anterior four, and a half of the fifth, are visible. In *Panochtus*, *Sclerocalyptus* (*Hoplophorus*), and *Plohophorus* six of the anterior teeth are visible. If these measurements are correct and the skull was associated with the carapace described, *Brachyostracon* (*Glyptodon*) *mexicanus* and *Brachyostracon cylindricus* represent not only a new genus but a new family of Glyptodonts.

The carapace in the Mexican Glyptodonts is distinctive, being peculiarly short and high with a greater width than length measured from border to border over the carapace. Near the lateral border vertical and horizontal rows of plates are defined but over the greater part of the carapace the rows are broken.

In the carapace of the primitive Miocene genus *Propalæohoplophorus* and in the Pliocene genus *Glyptotherium* the plates are disposed in transverse rows from border to border.

In the more specialized later genera, *Panochtus* and *Plohophorus*, the rows are retained near the border but are broken a short distance within the border thereby increasing the solidity of the carapace.

In the highly specialized genera there is a greater diversity of pattern. Lydekker[1] has noted this great diversity of pattern in plates from the same carapace, their various gradations and individual differences, in the genus *Glyptodon*.

The complete carapace of *Brachyostracon* still further exemplifies this variety and shows the impossibility of establishing valid species on single plates.

Carapace.— The form of the carapace (Plate XVI) is ellipsoidal in outline and robust, as in *Glyptodon*, but much shorter with postero-superior border recurved and high; anterior portion long, decurved and low.

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[1] Contributions to a knowledge of the Fossil Vertebrates of Argentine, 1894.

A convex hump above the sacrum reaches its highest point above the ilia and divides the carapace in two parts. This is also true of *Panochtus* and *Dædicurus*, but in these genera the part anterior to the hump is shortest whereas in *Brachyostracon* it is much longer.

Plates from widely separated parts of the carapace show a great variety in external sculpturing but all are characterised by a central, rounded figure surrounded by a single row of polygonal figures which vary from 8 to 12 in number.

The plates are quadrilateral, pentagonal and hexagonal, the form being determined by the number of adjoining plates in contact. Near the lateral border, where vertical and lateral rows are well defined, they are quadrilateral with central figures large, peripheral figures small and not well defined. Some distance within the border where vertical rows are not defined the plates are pentagonal or hexagonal.

The central figure in each plate is flat or slightly excavated except near the border of the carapace where it is slightly raised, convex, and so large as to nearly or quite cover the whole plate.

Toward the top of the carapace the plates are so thoroughly united that the peripheral border figures of adjoining plates fuse across the sutures forming pentagonal figures nearly as large as the central figure of each plate.

The border plates (Plates XVI, XVII, XVIII) are pendant and vary in form and size in different positions. Five plates in the middle of the lateral border project scarcely at all. Posteriorly they gradually increase in size, becoming very pointed. As the line of the posterior border rises they become less projecting but more massive reaching the greatest size and thickness on the reflexed superior surface.

Anterior to the lateral center the border plates increase in size but never reach the size of the posterior ones.

Several loose plates are preserved from between the carapace and the head shield; four of these are long, finger-like points similar to those in the first row of the head shield in *Glyptodon* figured by Lydekker (*loc. cit.*, Pl. V, *a*). Twenty-four others composed a part of the succeeding rows of the head shield. They are of irregular form and thin without border markings.

Atlas.— The atlas is of the same general form and proportion as in *Glyptodon* but a third smaller with articular surfaces for the axis actually and relatively larger. The vertebrarterial canal is twice the size of that *Glyptodon* and the spinous process is entirely obsolete.

The ribs and anterior chevron show no characters by which they can be distinguished from *Glyptodon*.

Pelvis.— The sacro-lumbar tube (Figs. 3 and 4) is composed of 16 vertebræ solidly united, with suture lines between centra and spines faintly indicated. Of these the anterior 7 are free, 4 are united with the ilia, 3 in the sacral arch are free and the last 2 are united with the ischia.

The crest of the spines form an arc, conforming to the carapace, with the greatest diameter at the point of union with the ilia, while the lower borders of the centra form an accentuated compound curve. Consequently the spines of the anterior vertebræ are nearly three times higher than those posterior to the ilia. This character is more pronounced than in any described Glyptodont.

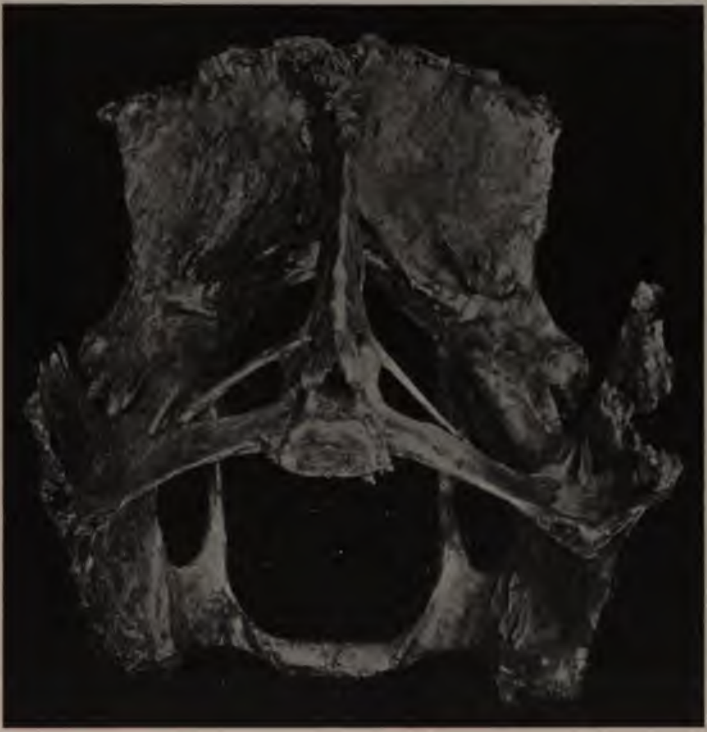


Fig. 3. ***Brachyostracon cylindricus.*** Sacro-lumbar tube. $\frac{1}{8}$.

The crests of the central spines are expanded and rugose for union with the carapace but apparently those in the extreme anterior and posterior ends did not unite with the carapace.

The ilia are not as massive as in *Glyptodon* but are inclined slightly forward of a vertical line as in that genus, with superior border greatly expanded.

The pubes are relatively larger than in *Glyptodon* with the cross-bar more massive than in any described form.

The ischia are broad thin expanded plates with superior borders considerably higher than the line of vertebral contra reaching a much greater height than in *Glyptodon;* intermediate in this respect between *Panochtus* and *Lomaphorus.*

The characters of the pelvis in *Glyptotherium* were only partly set forth in the original description by Osborn (Bull. Am. Mus. Nat. Hist., Vol. XIX, pp. 491–94, 1903) and it is described here in order to show the marked distinction between it and *Brachyostracon.*

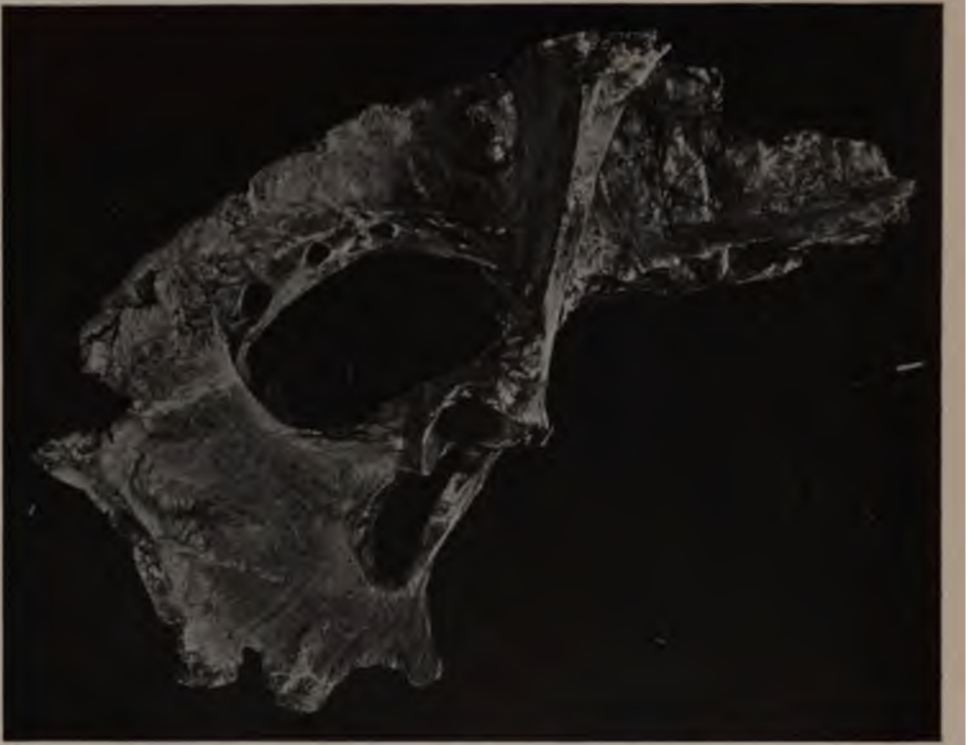


Fig. 4. *Brachyostracon cylindricus.* Sacro-lumbar tube, right side. $\frac{1}{6}$.

In *Glyptotherium* the compound curve of the sacrum is not more marked than in *Glyptodon*, so that anterior spines are not more than twice the height of posterior ones. Apparently there were 16 vertebræ in the sacrum but only three vertebræ united with the ilia and only one with the ischia. The pubes are reduced to very thin rods and there is no indication of a cross bar.

Summary.—From the known characters of the internal skeleton *Brachyostracon* appears to be related to the family Sclerocalyptidæ chiefly in the development of the teeth, in the elongate skull assigned to it and described by Cuatáparo and Ramirez, and in the general development of the pelvis. Some characters of the exoskeleton, as the lack of a lateral anterior prolongation of the carapace and the disposition of known head shield plates in rows, indicate an affinity to the family Glyptodontidæ.

Measurements of carapace.

	Greatest length	Greatest width border to border
Brachyostracon cylindricus	1.72 meters	2.44 meters
B. (Glyptodon) mexicanus	1.83 "	2.40 "

GLYPTODONTIA.

In all members of this suborder the endoskeleton is modified for the support of a highly complex exoskeleton in which striking characters of generic importance are present. But the tail sheath, usually made the chief basis of distinction, does not show characters of greater value in classification than any other part of the skeleton.

The order is separated at present into three families, the genera of which share many characters in common, chiefly of the exoskeleton. Were the endoskeletons as well known less difficulty would be experienced in classification. Without doubt the Glyptodontidæ and Sclerocalyptidæ include genera that pertain to other families but they cannot at present be separated.

In the following key I have given the chief characters by which the known genera are distinguished, omitting those of doubtful standing.

(A) GLYPTODONTIDÆ.

Glyptodon. Head truncated with nasals short and small. Teeth trilobate throughout with vaso-dentine markedly branched. Humerus without entepicondylar foramen. Manus with four digits. Pes with five digits. Pubis comparatively small with cross-bars united by cartilage. Head shield plates separate. Carapace large, robust and nearly spherical, without anterior lateral prolongation. Caudal sheath short and conical, composed of 9–10 rings with distal plates of each ring large and tuberculate.

Argentina and Brazil; Pleistocene.

Glyptotherium. Pubis greatly reduced, cross-bar vestigeal or absent. Carapace medium-sized and elongate, without anterior prolongation. Plates in transverse rows. Caudal sheath composed of 7 movable rings and a tube of 4 fused rings, distal rows in each ring slightly elevated.

Texas; Pliocene.

Propalæohoplophorus. Premaxillaries with vestigeal teeth. Anterior premolars simple cylinders. Sacrum composed of 7 or 8 vertebræ. Pubis small, cross-bar small or absent. Manus and pes with five digits. Head shield plates separate Carapace small, without marked anterior lateral prolongation. Plates in transverse rows. Caudal sheath composed of 5 or 6 rings and a terminal tube of two rings closed by a single plate.

Santa Cruz of Patagonia; Miocene.

Cochlops. Skull and teeth similar to *Propalæohoplophorus.* Head shield plates separate but smaller, thicker and more numerous than in *Propalæohoplophorus.* Carapace small, plates rough and punctate, with a wide transverse band near the middle, and some over pelvis tuberculate.

Santa Cruz of Patagonia; Miocene.

Eucinepeltus. Head shield composed of 11–15 plates coössified, with suture lines raised and no sculptural pattern. Carapace medium-sized with plates marked as in *Propalæohoplophorus,* but with central figure not elevated and border plates non-serrate.

Santa Cruz of Patagonia; Miocene.

Neothoracophorus. Anterior premolar of lower jaw small and conical. Carapace medium-sized. Plates small, thick and united by tissue, only the central elevated figure surrounded by plane surface. Caudal sheath composed of rings as in Glyptodon.

Argentina; Pleistocene.

(B) SCLEROCALYPTIDÆ.

Sclerocalyptus (*Hoplophorus*). Anterior teeth elliptical. Carapace medium sized, long, straight and cylindrical with anterior lateral prolongation. Manus and pes with four digits. Plates large, with central figure very large and peripheral figures small. Caudal sheath composed of 5? anterior movable rings and a long tube ornamented with elliptical figures.

Argentina and Brazil; Pleistocene.

Lomaphorus. First anterior premolars in each jaw cylindrical. Carapace medium-sized and elongate with anterior lateral prolongation. Plates with large round central figure surrounded by single row of polygonal figures. Caudal sheath composed of 3 or 4 rings, terminal tube short and wide.

Argentina; Pleistocene.

Panochtus. First lower premolar an elongate ellipse, perpendicular angles present. Manus and pes with four digits. Carapace largest of order, an elongate oval with anterior lateral prolongation. Dorsal region raised above pelvis in a hump. Plates marked by polygonal figures of equal size and complete; central figure sometimes present. Caudal sheath with six rings and a long flattened tube ornamented with tubercles.

Argentina; Pleistocene.

Plohophorus. Carapace medium-sized with anterior lateral prolongation. Plates thin with central figure surrounded by two lines of peripheral figures. Caudal sheath terminating in a cylindrical tube.

Argentina (Araucanian formation); Pliocene.

Palæohoplophorus. Carapace medium-sized. Plates with large central figures surrounded by two lines and a third incomplete line of peripheral figures. Caudal sheath with 2? movable rings and a conical elliptical tube as in *Sclerocalyptus*.

Argentina (Patagonia formation); Miocene.

Brachyostracon. Two anterior lower premolars elliptical, vaso-dentine ridges feebly branched, sacrum composed of 16 vertebræ; 4 united with ilia and 2 united with ischia. Pubis large and cross-bar massive. Carapace large and elliptical; a prominent medium hump divides it into a short posterior recurved and a long anterior decurved end. Plates of carapace inside of border with round central figure surrounded by single row of eight to twelve peripheral figures.

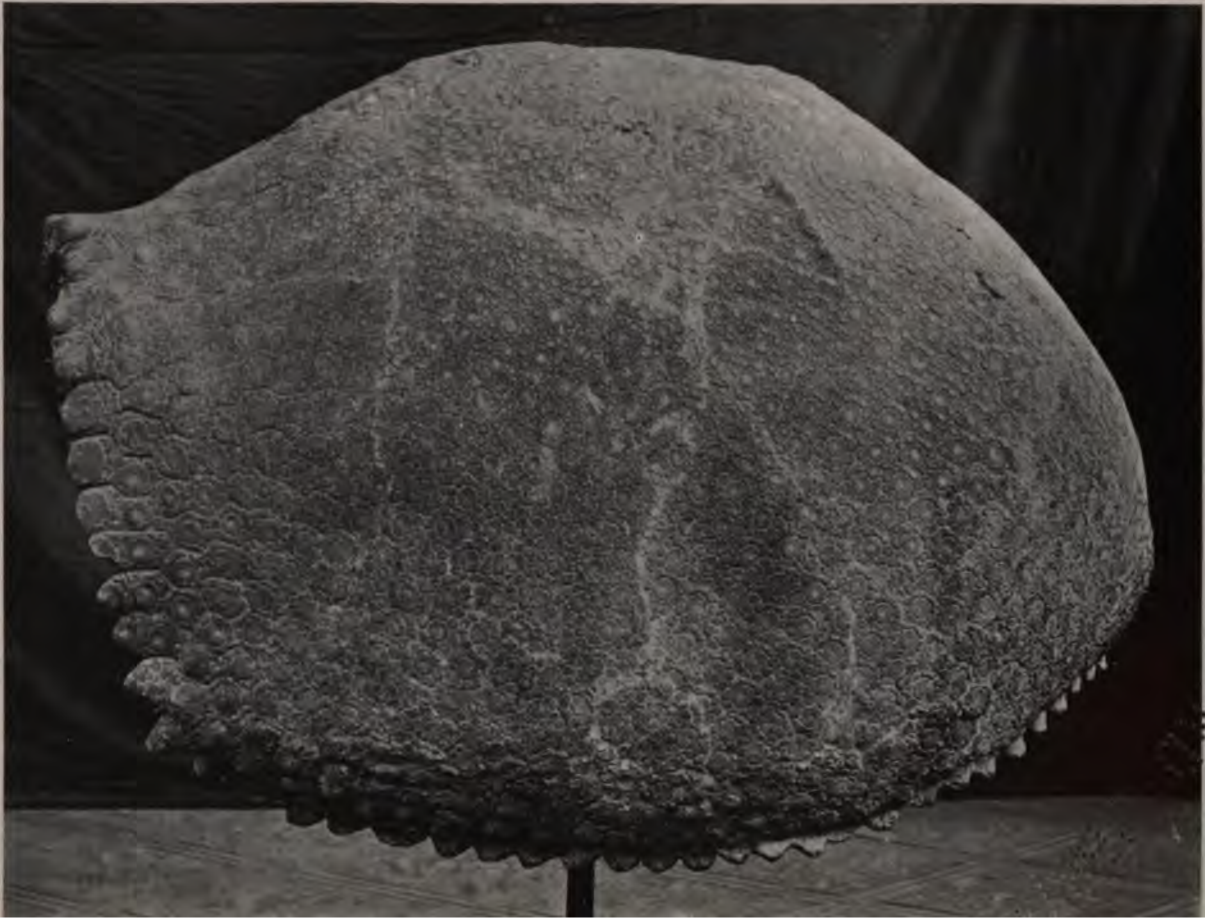
(C) DŒDICURIDÆ.

Neuryurus. Anterior premolars small and elliptical. Carapace medium to large size. Plates of carapace small and disposed in transverse rows; surface elevated in center and pitted, without figures. Caudal sheath ending in long depressed tube composed of plates similar to those of carapace excepting on lateral face when plates are elliptical and large.

Argentina, Miocene; Brazil, Pleistocene.

Dœdicurus. Head convex as in *Panochtus* and orbit completely enclosed by bony ring. First premolars smaller than succeeding teeth and semi-elliptical. Humerus with entepicondylar foramen. Manus with three functional digits. Pes with four digits. Head shield formed of small plates not suturally united. Carapace large, with anterior lateral prolongation. Plates polygonal, no figures, pitted, and convex or plane with three or five large openings on surface. Caudal sheath a large tube, very long, depressed and thickened transversely at the end where it is ornamented with large spines.

Argentina and Uruguay; Pleistocene.



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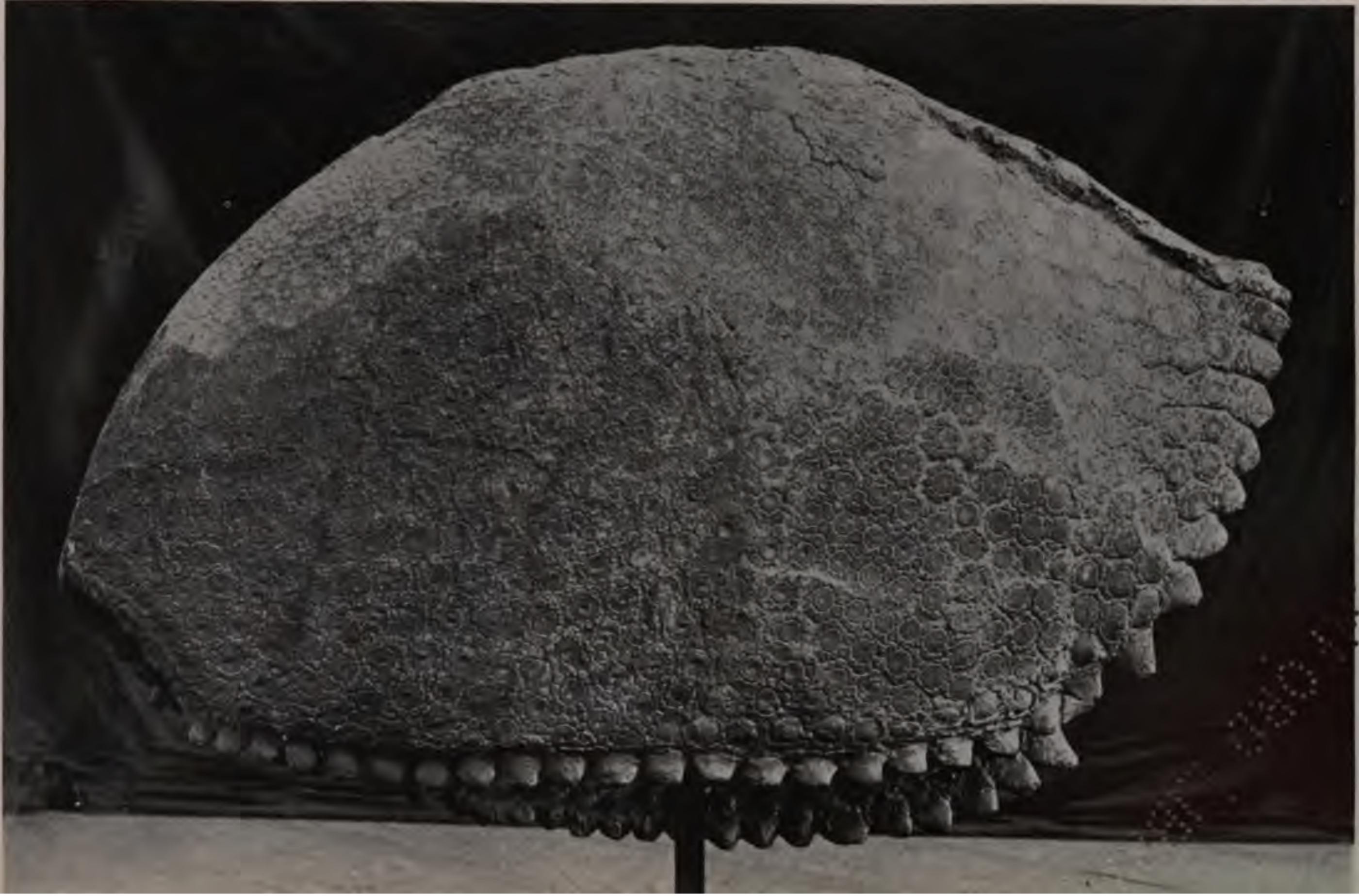
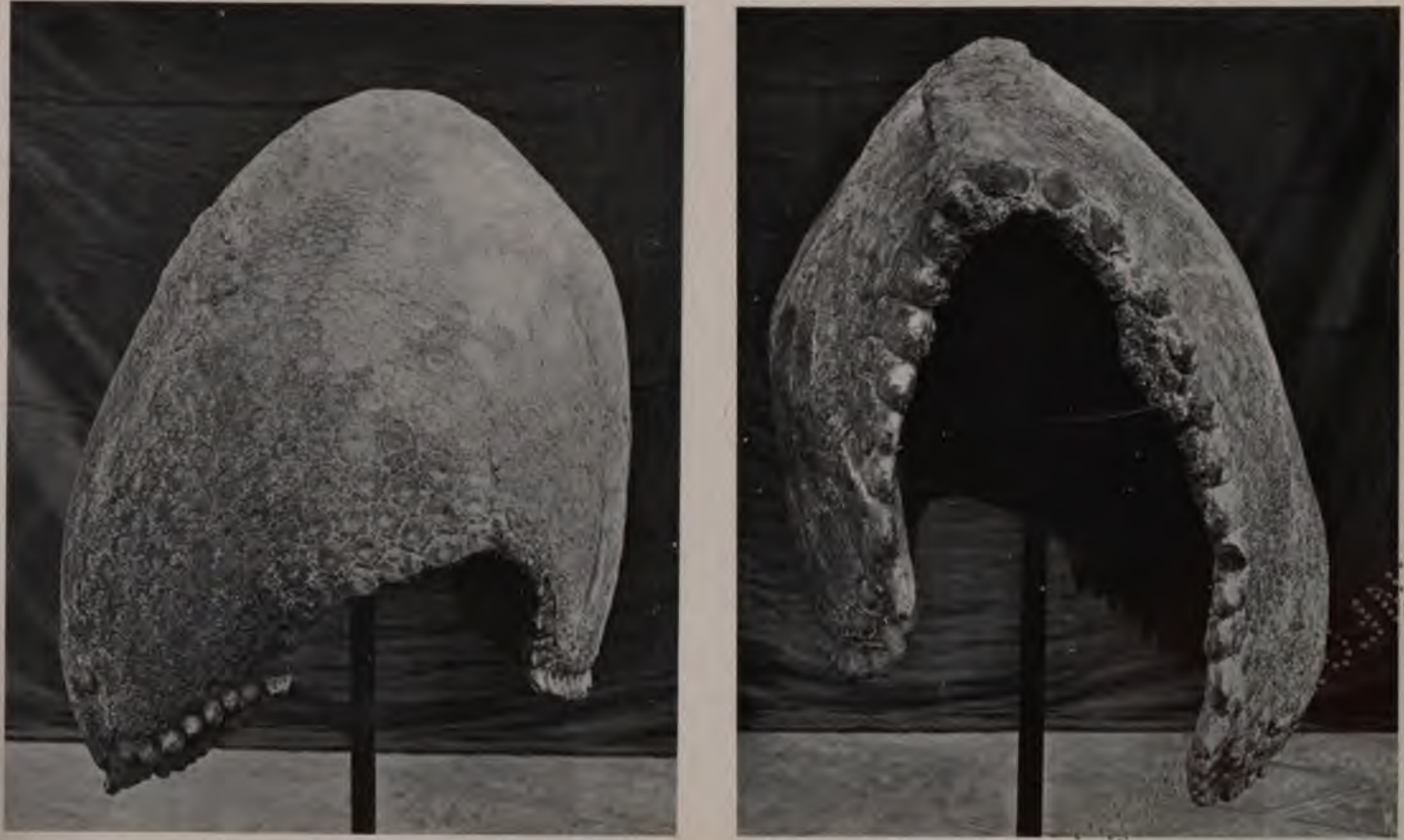
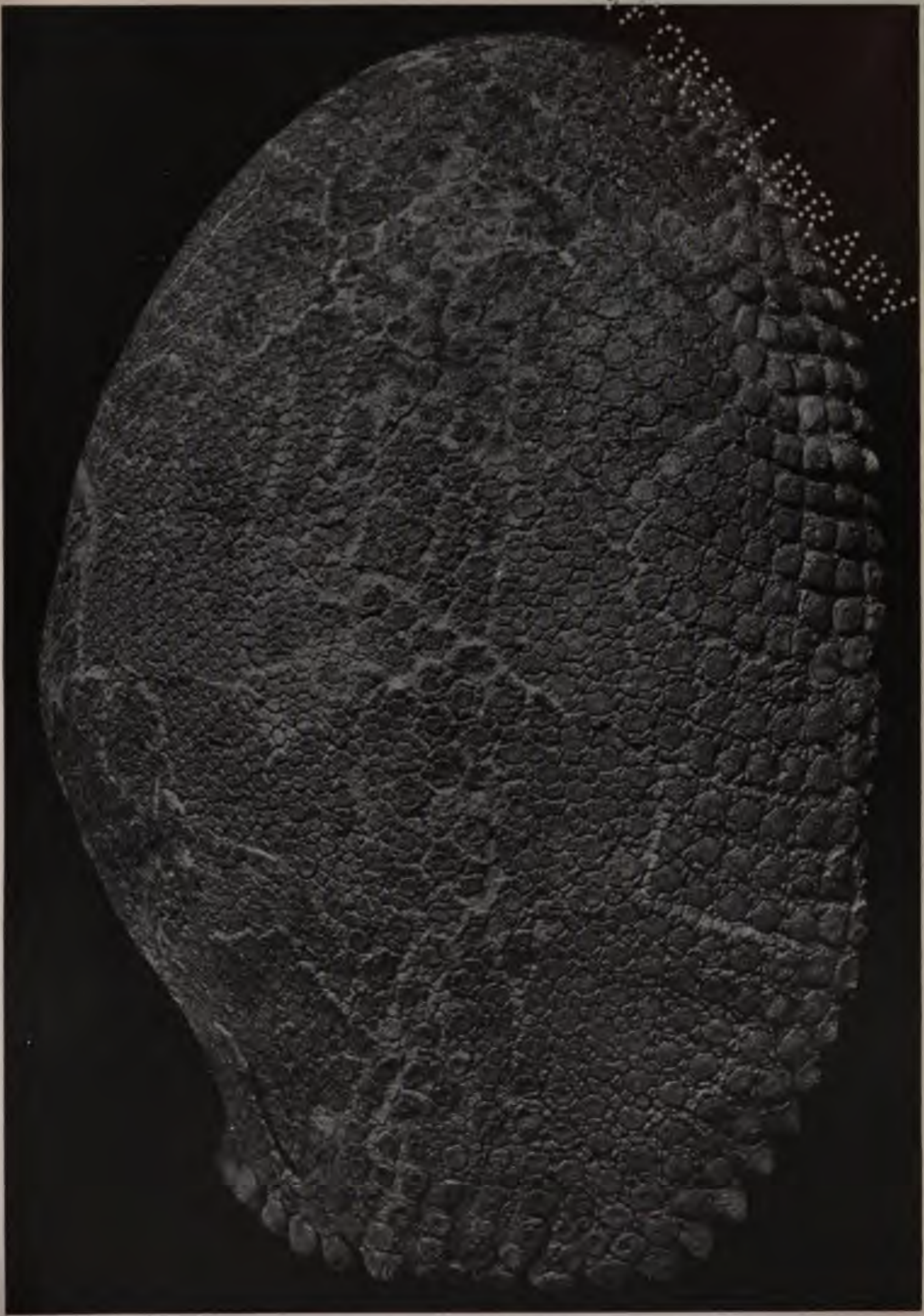
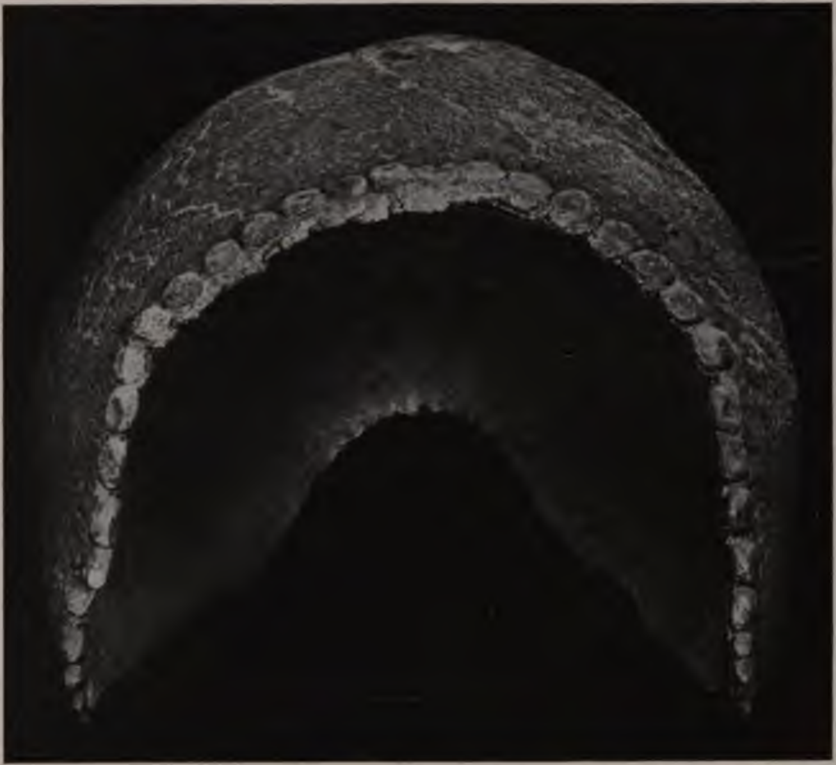




BRACHYOSTRACON (GLYPTODON) MEXICANUS. TYPE.





BRACHYOSTRACON CYLINDRICUS. TYPE. POSTERIOR VIEW. $\frac{1}{6}$.

59.7(729.1)

Article XVIII.— NOTES ON CUBAN FISHES.

By John Treadwell Nichols.

I. A small Fresh-water Collection made by Mr. Barnum Brown in 1911.

Mr. Barnum Brown writes: "While collecting fossils in the Province of Santa Clara, Cuba, in 1911, my work took me to Baños de Ciego, Montero, 30 miles north of Cienfuegos. Here occur three hot springs having a temperature respectively of $93\frac{1}{5}$, $96\frac{4}{5}$ and $99\frac{5}{7}$ degrees Fahrenheit. These springs are grouped close together, not more than 20 yards apart and about 200 yards from the Analla River into which they drain. The springs of $93\frac{1}{5}$ and $96\frac{4}{5}$ degrees temperature are walled in and the latter is surrounded by a hotel. The one of $99\frac{5}{7}$ degrees temperature is of largest volume and has direct communication with the river. In this spring as well as in the drainage water of the other springs and the cold water of the river, I found a great many fishes, mostly viviparous.

"The following species have been identified from the spring:

Symbranchus marmoratus Bloch.
Gambusia puncticulata Poey.
Glaridichthys falcatus Eigenmann.
Girardinus matallicus Poey.
Pœcilia vittata Guichenot.
Heros tetracanthus (Cuv. & Val.).

Of these the eel-like *Symbranchus marmoratus* was found only in the hot spring. The other species so far as I was able to observe, were common to both the cold water of the river and that of the hot springs, and it seemed evident that they, in part at least, followed up from the cold river water through the drainage of the hot springs, becoming acclimated by degrees, until they were finally able to live in the hottest water, 37° Centigrade, approximately that of blood temperature.

"I was curious to know if it were possible for these fishes to live equally well in the hot spring water of $99\frac{5}{7}$ degrees temperature and the river water of 60° temperature without first going through a process of acclimatization, so conducted a number of experiments. It was quite evident that fishes could gradually come from the cold water into that of the hottest temperature, so I took a number from the hot spring, carefully catching them in a net so as to avoid injury and placed some in river water and others in water from the other springs. Those placed in water of $93\frac{1}{8}$ degrees temperature seemed to live in it as well as in that of $99\frac{5}{7}$ degrees, but of those placed in river water, out of eleven fishes, nine died within ten minutes. The other two lived.

"This experiment was repeated several times with similar results; more than two thirds failing to resist the sudden change of temperature.

"I am unable to tell whether those used in the experiments were *Gambusia puncticulata*, *Glaridichthys falcatus*, *Girardinus metallicus*, or *Pœcilia vittata* but probably they were mostly the latter genus and species, as this form was most abundant in the Chapapote spring.

"While living in the hotel during a heavy storm the Analla River overflowed, sending a branch across this Chapapote spring. The following day we pumped out the water finding a great many viviparous fishes, probably all of the four determined small species and a number of viajecos, *Heros tetracanthus*. Evidently they had all become acclimated to the hot water during the time of this overflow."

Besides the species he mentions, Mr. Brown's collection contains two species which were not found in the warm spring he is discussing, *Gambusia punctata*, Poey, of which he obtained two from the Rio Analla and several from a tributary of the Zaza, and *Glaridichthys torralbasi* Eigenmann, of which he secured one specimen from the latter locality.

II. MARKET AND OTHER FISHES, INCLUDING TWO NEW SPECIES, OBSERVED IN 1912.

The following annotated list, including notes on two hitherto undescribed species, is of the fishes observed in Cuba during a short stay about March 1, 1912. It is based largely on those seen in the markets but, with due allowance for this fact, should give some idea of the rich Cuban marine fauna at that season and be of service to students of Cuban fishes. It should also have economic interest.

From February 21 to March 2, and again from March 7 to 9, the writer was in or near Havana, examining the markets and doing a very little independent collecting; March 3 at Matanzas, March 5 at Aguada in Sta. Clara Province, and March 6 and 7 at Cienfuegos.

DASYATIDÆ.

1. **Dasyatis** sp.

One seen gliding over the bottom at Marianao. One or two small ones cut up for sale in the Havana market, March 8 and 9.

LEPISOSTEIDÆ.

2. **Lepisosteus tristœchus** (*Bloch & Schneider*).

Several specimens of the Cuban garpike were taken for me from the Anabana River at Aguada by Dr. Carlos M. Campos, March 5, the largest about three feet long. Some of them were full of developed eggs. The species is considered identical with the alligator gar from the Mississippi and these Cuban specimens resembled it in their robust bodies, sculptured scales and arrangement of teeth, differing markedly in these respects from *L. platostomus*. They were browner, *i. e.*, less greenish, and smaller than alligator gars from Mississippi in the museum collections, and unspotted, whereas these Mississippi fish have spots on the posterior fins.

ANGUILLIDÆ.

3. **Anguilla chrysypa** (*Rafinesque*).

Not uncommon in the Havana market.

MURÆNIDÆ.

4. **Lycodontis funebris** (*Ranzani*).

One small specimen in the Havana market. The dealer from whom I bought it had probably laid it out for me, as he said it was poisonous, and knew I wanted it for a museum specimen.

ELOPIDÆ.

5. **Tarpon atlanticus** (*Cuv. & Val.*).

This fish, which I believe is seldom eaten by the sportsmen who capture it in Florida, was seen once or twice in the Havana market.

6. **Elops saurus** *Linn.*

Common in the markets.

ALBULIDÆ.

7. **Albula vulpes** (*Linn.*).

Not uncommon in the Havana market.

CLUPEIDÆ.

8. **Clupanodon pseudohispanicus** (*Poey*).

Abundant in the Havana market.

9. **Sardinella sardina** (*Poey*).

Abundant in the Havana market.

10. **Sardinella macrophthalmus** (*Ranzani*).

Tolerably common in the Havana market. A fisherman was seen catching them with small hook and fine line, Havana Harbor, February 25.

11. **Opisthonema oglinum** (*Le Sueur*).

Common in the Havana market.

ENGRAULIDIDÆ.

12. **Stolephorus browni** (*Gmelin*).

Abundant, Havana market, etc.

13. **Stolephorus productus** (*Poey*).

Common, Havana market, etc.

PŒCILIIDÆ.

14. **Rivulus marmoratus** *Poey.*

Common in brackish water at Marianao.

15. **Cyprinodon variegatus riverendi** (*Poey*).

Common at Marianao.

16. **Gambusia puncticulata** *Poey.*

Common in a mangrove grown lagoon at Marianao.

17. **Pœcilia vittata** *Guichenot.*

Abundant in brackish water at Marianao. A little ditch which ran from the mangrove swamp to the shore was alive with these robust active fishes. It is interesting to find them in waters of different salinity as did Mr. Brown in waters of different temperature.

ESOCIDÆ.

18 **Tylosurus raphidoma** (*Ranzani*).

Fishes of this genus were common in the markets; a small specimen purchased proved of this species.

HEMIRAMPHIDÆ.

19. **Hemiramphus brasiliensis** (*Linn.*).

Tolerably common in the Havana market.

SYNGNATHIDÆ.

20. **Siphostoma torrei** n. sp.

The type and only specimen obtained, No. 3359, American Museum of Natural History, was taken in brackish water close to the wall along the San Juan River in the city of Matanzas, March 3. It is a ♀ 150 mm. long to base of caudal. Head 5 times in this measure. Depth 3.8 in head. Snout 1.6, eye 8.2 Postorbital part of head 3.4. Snout slender. Tail equal to trunk without head. Ridges on head low, those on body distinct, moderate. 19 + 23 rings. Dorsal on 2½ + 6, low, with about 42 rays. Color in spirits mottled brownish, whiter on the back, with a narrow silvery streak on the flanks, running almost the entire length of the trunk.

The ring formula separates this species from other members of the genus with the exception of *Siphost oma poeyi* Jordan & Evermann, from which it differs in the higher dorsal count and minor characters. In naming it for Dr. Carlos De La Torre, formerly of Matanzas, the type locality, now of the University of Havana, the writer ventures to hope that this paper may be of some slight service to Dr. De La Torre in the thorough study of Cuban fishes he is undertaking.

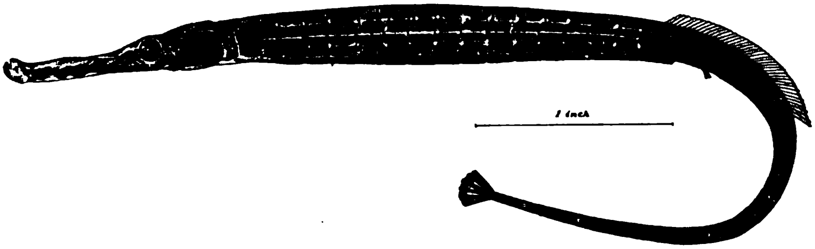


Fig. 1. *Siphostoma torrei* n. sp.

ATHERINIDÆ.

21. **Atherina stipes** *Müller & Troschel* [*Atherina laticeps* Poey].

Used salted for bait at Marianao, where I was told they were eaten fresh.

MUGILIDÆ.

22. **Mugil gaimardianus** *Desmarest.*

This genus was common in the markets, and young were taken at Marianao. Those identified belonged to this species, which was probably not the only one present.

SPHYRÆNIDÆ.

23. **Sphyræna picuda** *Bloch & Schneider.*

Small specimens were seen in the markets several times; a larger one caught by fishermen at Marianao, a large one in the Cienfuegos market. It is considered one of the four most poisonous Cuban fishes, and its sale is prohibited in Havana and Matanzas. The others are *Caranx latus,* the large *Seriola,* and *Lycodontis funebris.* It is said that by no means all the fish of these species are poisonous and the smaller ones are safer. The symptoms are sometimes alimentary disorders, sometimes skin troubles. The cause is not known.

24. **Sphyræna guachancho** *Cuv. & Val.*

A much prized food fish very abundant in the markets.

POLYNEMIDÆ.

25. **Polydactylus virginicus** (*Linn.*).

A few. Havana market.

HOLOCENTRIDÆ.

26. **Holocentrus ascensionis** (*Osbeck*).

Tolerably common in the Havana market.

27. **Holocentrus coruscus** *Poey.*

One small one taken in a pool at Marianao.

MULLIDÆ.

28. **Upeneus maculatus** (*Bloch*).

Several small ones seen in the Havana market.

SCOMBRIDÆ.

29. **Scomberomorus regalis** (*Bloch*).

Common in the Havana market. Mostly small ones. Not in very good repute. One of the leading fishermen said it is sometimes poisonous.

30. **Scomberomorus cavalla** (*Cuv. & Val.*).

Abundant in the Havana market; and much prized.

31. **Acanthocybium solandri** (*Cuv. & Val.*).

Seen once in the Havana market on February 22; two or three large individuals.

TRICHIURIDÆ.

32. **Trichiurus lepturus** *Linn.*

One in the Havana market, March 9, called "sabe."

CARANGIDÆ.

33. **Elagatis bipinnulatus** (*Quoy & Gaimard*).

One in the Havana market March 8.

34. **Trachurops crumenophthalmus** (*Bloch*).

Abundant in the Havana market, both large and small ones, the latter mixed with Clupeids and Gerrids, the Clupeids forming the bulk of, and *Clupanodon pseudohispanicus* being the most abundant species in these mixtures.

35. **Caranx ruber** (*Bloch*).

Under the Cuban name of "cibi," this fish and *Caranx bartholomæi* are considered unsafe for food and their sale in the Havana market prohibited. Yet the writer has two specimens selected to show extremes of variation from a lot averaging about 8 inches in length which were for sale there March 9. The larger of these is 210 mm. long with a depth of 3.5 in length to notch of caudal fin; the other 200 mm. with depth of 3.4. They are thus almost the same size as a *Caranx bartholomæi* 220 mm. long from Cienfuegos, and on carefully contrasting them with this specimen they show the distinguishing characters of the two species. The *ruber* are slightly more slender, with more graceful lines, their lower jaws project slightly instead of being slightly included, their gillrakers are closer set, more slender and numerous, 32 instead of 20 on the lower limb of the arch. The peduncular scutes form a lower keel posteriorly and appear broader anteriorly. There is a distinct black band diagonally from the top of the peduncle backward and downward along the upper margin of the lower caudal lobe. The writer has not seen this mark in *bartholomæi*, but a small specimen of *ruber* 90 mm. long (depth to notch of caudal 2.7) from the Russell J. Coles, Cape Lookout (North Carolina) collections, has it well marked. This small fish has the recumbent dorsal spine somewhat better developed than the larger ones, which yet have evidence of it.

36. **Caranx bartholomæi** *Cuv. & Val.*

A specimen 220 mm. long from the Cienfuegos market has the depth of body in length to notch of caudal fin 3.1. A specimen 55 mm. long from the Havana market February 26 has this same measurement 2.3. Four specimens from the Russell J. Coles collections from North Carolina, 100 to 140 mm. long, have it about 2.5. All the specimens have a recumbent spine at the front of the spinous dorsal, which is small and concealed, except in the 55 mm. one.

37. **Caranx hippos** (*Linn.*).

Small specimens abundant in Havana and Cienfuegos markets.

38. **Caranx crysos** (*Mitchill*).

Three specimens were found in the Havana market March 8 and 9.

Table of Variation.

Length of fish	about 120 mm.	about 240 mm.	about 280 mm.
Depth to notch of caudal	2.9	3.3	3.5
Body	compressed	less compressed	still less compressed
Pectoral length	equal to head	$\frac{1}{6}$ longer than head	more than $\frac{1}{5}$ longer than head
Scutes	51	46	45

The lesser depth and greater thickness of the body are unquestionably age characters.

39. **Caranx latus** *Agassiz.*

Three small specimens from the Havana market 140 to 170 mm. long, have the depth 2.6 to 2.7 in length to notch of caudal fin. A large one about 950 mm. long seen in the Cienfuegos market had the depth 3.5 in this measure. *Caranx fosteri* Cuv. and Val. seems after all to be the adult of *Caranx latus*. From the Hawaiian " ulua " this species differs in the more rounded forehead outline, fewer vertical fin rays, fewer and larger scutes, and more abruptly arched lateral line. The "ulua" is probably *Caranx peronii* Cuv. & Val. It is not *Caranx parapistes* Richardson, the type figure of which is readily identifiable as *Caranx fosteri* Cuv. & Val. = *Caranx latus* Agassiz.

40. **Vomer setipinnis** (*Mitchill*).

One specimen found in the Havana market.

41. **Vomer gabonensis** *Guichenot.*

A single specimen found in the Havana market with a specimen of *V. setipinnis*. Five specimens found in the Cienfuegos market.

42. **Selene vomer** (*Linn.*).

A few specimens seen in the Havana and Cienfuegos markets.

43. **Chloroscombrus chrysurus** (*Linn.*).

Common in the Havana market.

44. **Trachinotus falcatus** (*Linn.*).

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[1] See Nichols, Bull. Am. Mus. Nat. Hist., Vol. XXVIII, Art. XV.

One large one of perhaps six lbs. cut into strips, was seen at the Havana market, and also two or three young.

CORYPHÆNIDÆ.

45. **Coryphæna hippurus** *Linn.*

Two specimens, each of about twenty pounds weight, seen in the Havana market under the name of "dorad."

CENTROPOMIDÆ.

46. **Centropomus pedimacula** *Poey.*

This genus was common in the markets and small ones were seen swimming along the water front of the San Juan River at Matanzas. Those identified belonged to this species.

SERRANIDÆ.

47. **Petrometopon cruentatus** (*Lac.*).

Common in the Havana market.

48. **Bodianus fulvus ruber** (*Bl. & Schn.*)

Abundant in the Havana market where *B. f. punctatus* was not uncommon.

49. **Epenephelus adscensionis** (*Osbeck*).

Abundant in the Havana market.

50. **Epenephelus striatus** (*Bloch*).

Abundant in the Havana market.

51. **Mycteroperca venenosa** (*Linn.*).

Seen in the markets.

52. **Diplectrum radiale** (*Quoy & Gaimard*).

One, Havana market.

53. **Diplectrum formosum** (*Linn.*).

One, Havana market.

54. **Prionodes phœbe** (*Poey*).

One taken by fishermen at Marianao.

LUTIANIDÆ.

55. **Neomænis griseus** (*Linn.*).

Abundant in the Havana market.

56. **Neomænis apodus** (*Walbaum*).
Several seen in the Havana market.

57. **Neomænis bucanella** (*Cuv. & Val.*).
Not uncommon in the Havana market.

58. **Neomænis aya** (*Bloch*).
Common in the Havana market.

59. **Neomænis analis** (*Cuv. & Val.*).
Abundant in the markets.

60. **Neomænis synagris** (*Linn.*).
Abundant in the Havana market.

61. **Ocyurus chrysurus** (*Bloch*).
Abundant in the Havana market.

62. **Aprion macrophthalmus** (*Müller & Troschel*).
Not uncommon in the Havana market.

63. **Etelis oculatus** (*Cuv. & Val.*).
Not uncommon in the Havana market.

HÆMULIDÆ.

64. **Hæmulon album** *Cuv. & Val.*
A few seen in the Havana market.

65. **Hæmulon parra** (*Desmarest*).
A few in the Havana and many in the Cienfuegos market.

66. **Hæmulon sciurus** (*Shaw*).
Seen in the Havana market, and one caught on hook and line at Marianao. This fish uttered a short grating sound suggesting a squirrel gnawing a nut.

67. **Hæmulon plumieri** (*Lac.*).
Tolerably common in the Havana market.

68. **Bathystoma rimator** (*Jordan & Swain*).
A specimen 5 inches long from the Havana market February 26, has the depth $2\frac{3}{4}$ to base of caudal. Though this species appears not to have been previously recorded from Cuba, it seems highly improbable that so small a fish would be brought across from Florida.

69. **Bathystoma striatum** (*Linn.*).
Two or three specimens caught by fishermen at Marianao had no noticeable red or yellow color in the mouth when fresh.

70. **Anisotremus virginicus** (*Linn.*).
Seen once in the Havana market.

71. **Orthopristis poeyi** *Scudder.*
A few seen in the Havana market.

SPARIDÆ.

72. **Calamus proridens** *Jordan & Gilbert.*

73. **Calamus bajonado** (*Bl. & Schn.*).

The genus *Calamus* was commonly represented in the markets. Specimens of these two species were obtained and identified.

74. **Archosargus unimaculatus** (*Bloch*).

Tolerably common in the Havana market.

GERRIDÆ.

75. **Eucinostomus harengulus** *Goode & Bean.*

A specimen 150 mm. long from the Havana market agrees admirably with descriptions of this species.

76. **Eucinostomus gula** (*Cuv. & Val.*).

Several specimens obtained from among the small Gerrids common in the Havana market proved to be this species.

77. **Xystæma havana** n. sp.

The type No. 3358, American Museum of Natural History, was caught at Marianao Beach, Havana, February 28, on sandy bottom, from a small pier, with hook and line, at night. It is 127 mm. long to base of caudal. Depth 2.7 in this measure. Head 3.1. Eye 2.9 in head. Maxillary 3.4. The eye is very large, the head broad and blunt, the mouth small, so that the maxillary barely reaches the eye. The diameter of the eye is slightly greater than the length of snout which equals the distance between the eyes. The second anal spine, stouter than the third, which it equals in length, is contained 2.7 times in the head. Dorsal IX, 10, anal III, 7. Premaxillary grove, naked, linear. The scales running forward along its sides to just beyond front of eye, but not crossing it. Broad scaly sheathes at bases of dorsal and anal. Scales 4–42–9. Enlarged interhæmal spine long, narrow and solid like that of *Xystæma cinereum*, but somewhat differently shaped, a deep lateral furrow running the length of it. Preopercle entire. Color when fresh silvery, no cross bars, rows of scales on center of sides with faint longitudinal streaks. Spinous dorsal tipped with blackish.

This fish has a larger eye, smaller mouth and less trenchant outlines than either *Xystæma cinereum* or *Eucinostomus harengulus.* It is narrower than the former, lacks its cross bars, and has the naked area on the head narrower with less flaring sides. It has the top of the head much broader and less pointed than the latter. It resembles *Eucinostomus dowi* (Gill) described from the Pacific, and would probably be easily mistaken for that species, but Mr. Barton A. Bean of the U. S. National Museum has kindly examined one of the cotypes of *E. dowi* and found the enlarged interhæmal as it should be in *Eucinostomus.* The large eye and plain color would be appropriate for a nocturnal species. The name is for the steamship 'Havana' on which we made two comfortable trips between New York and that port.

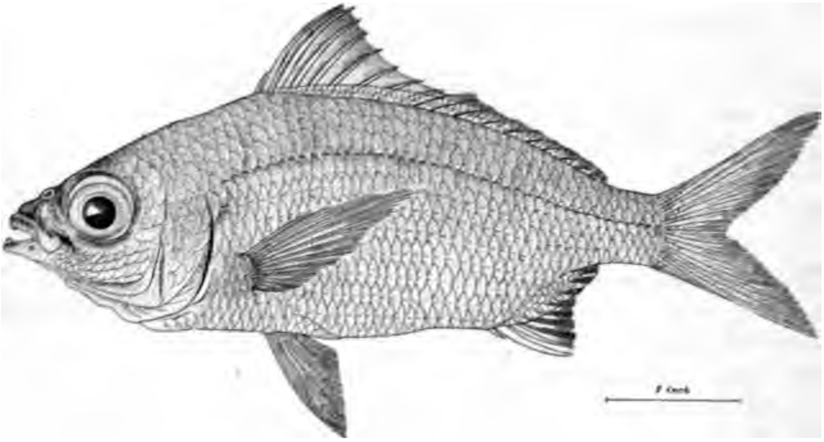

Fig. 2. *Xystæma havana* n. sp.

In going over the Museum's material for comparison the writer finds three specimens of this new species collected at Miami, Florida, by the Fabbri Tekla Expedition in 1910. They are 120, 82, and 60 mm. long, and agree well with the type. The largest of them has a somewhat longer maxillary, 3.3 in the head.

78. **Xystæma cinereum** (*Walbaum*).
Common in the Havana market.

79. **Gerres olisthostomus** *Goode & Bean.*
Tolerably common in the Havana market.

80. **Gerres brasiliensis** *Cuv. & Val.*
A number seen in the Cienfuegos market.

SCIÆNIDÆ.

81. **Bairdiella ronchus** (*Cuv. & Val.*).
Not uncommon in the Havana market.

82. **Micropogon furnieri** (*Desmarest*).
Common in the Havana market.

CICHLIDÆ.

83. **Heros tetracanthus** (*Cuv. & Val.*).

A few from the Anabana River at Aguada.

POMACENTRIDÆ.

84. **Chromis multilineatus** (*Guichenot*).

Apparently caught commonly by the fishermen at Marianao. The color of a specimen was livid purplish, whiter on chest and fuscous on nape, with indistinct streaks along the rows of scales. Dorsal blackish with a narrow orange tip and the last one or two rays lighter, a lemon yellow blotch on the back about the base of the last ray. Caudal white with blackish upper and lower borders and the tips of the lobes orange, a narrow yellow streak from the orange tips outside the blackish borders. Pectoral, ventral and anal fins more or less orange. A jet black blotch at the axil of the pectoral.

85. **Eupomacentrus fuscus** (*Cuv. & Val.*).

Abundant in somewhat brackish water along the water front at Matanzas. No specimens were secured, but color variations of the living fish were observed at close range. Their caudal fins were varyingly dusky or yellowish, but none of the fish had the yellow color running forward on the under parts as it frequently does in *leucostictus*. Some small ones were observed which were bright blue on the head and front part of the back and had one or more dark lengthwise stripes on the head,—somewhat different from any coloring of *leucostictus*. A few large ones swimming about actively had the back and fore part of the sides pale ashen, but the same individuals became uniform dusky when they ceased their activity. The motions of this species seem less gliding and wrasse-like than those of *Eupomacentrus leucostictus*.

86. **Eupomacentrus leucostictus** (*Müller & Troschel*).

Common in rock pools at Marianao.

87. **Abudefduf saxatilis** (*Linn.*).

Small ones common in rock pools at Marianao and Havana.

LABRIDÆ.

88. **Lachnolaimus maximus** (*Walbaum*).

Tolerably common in the Havana market.

89. **Harpe rufa** (*Linn.*).

One in the Havana market.

90. **Iridio cyanocephalus** (*Bloch*).
Identified once in the Havana market.

91. **Iridio maculipinna** (*Müller & Troschel*).
Two or three very young wrasses in pools at Marianao were probably this species.

92. **Iridio bivittatus** (*Bloch*).
One in a small pool at Marianao.

SCARIDÆ.

93. **Sparisoma chrysopterum** (*Bloch & Schneider*).
Identified once in the Havana market.

94. **Scarus cæruleus** (*Bloch*).
Identified once in the Havana market.

EPHIPPIDÆ.

95. **Chætodipterus faber** (*Brouss*).
Not uncommon in the Havana market.

TEUTHIDIDÆ.

96. **Teuthis** sp.
Seen once or twice.

BALISTIDÆ.

97. **Balistes vetula** *Linn.*
A dead specimen at Cojimar, Feb. 25. One in Havana Market March 8 or 9.

SCORPÆNIDÆ.

98. **Scorpæna plumieri** *Bloch.*
One seen in the Cienfuegos market.

GOBIIDÆ.

99. **Guavina guavina** (*Cuv. & Val.*).
One specimen from the Havana market Feb. 26.

100. **Lophogobius cyprinoides** (*Pallas*).

Two specimens from the Havana market Feb. 26.

101. **Gobius soporator** *Cuv. & Val.*

Generally abundant along the shore.

102. **Gobius boleosoma** *Jordan & Gilbert.*

Several in brackish water at Marianao.

103. **Gobius oceanicus** *Pallas.*

Commonly sold *en masse* in the Havana market.

BATRACHOIDIDÆ.

104. **Opsanus tau** (*Linn.*).

Common in the Havana market, alive.

Gobiesocidæ.

105. **Arbaciosa rupestris** (*Poey*).

These little fishes, less than 1½ inches long, were common, pressed against the rocky bottoms and sides of spray-whipped pools, just beyond reach of the surf at the edge of a jutting rocky shore at Marianao. Taken out of water they seemed little inconvenienced and made some progress by wriggling and clinging. The colors of a living specimen were as follows: Pale. Six more or less bilaterally divided dark saddle-like blotches along the back, the upper parts marked with a fine network or orange and dusky mottling which leaves conspicuous shining white spaces on the sides.

BROTULIDÆ.

106. **Ogilbia cayorum** *Evermann & Kendall.*

One specimen two inches long from the Havana market in February. The species was described from Florida but it seems very improbable that our small specimen was brought from there.

PLEURONECTIDÆ.

107. **Platophrys maculifer** (*Poey*).

One specimen from the Havana market Feb. 26.

108. **Syacium micrurum** *Ranzani.*

One small ♀ specimen from the Havana market Feb. 26.

109. **Citharichthys spilopterus** *Günther.*

Common in the Havana market.

SOLEIDÆ.

110. **Achirus lineatus** (*Linn.*).
One in the Havana market March 9.

ANTENNARIIDÆ.

111. **Antennarius** sp.
One minute specimen at Marianao.

56.7,38 (117:7)

Article XIX.—THE CRETACEOUS CHIMÆROIDS OF NORTH AMERICA.

BY L. HUSSAKOF.

PLATES XIX AND XX.

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INTRODUCTION.

The chimæroids reached their maximum evolution during the Cretaceous period. They were then represented by a larger number of genera, by a greater abundance of individuals, and by huger forms than at any other period. Among them were fishes ten and fifteen feet in length, to judge by their dental plates as compared with those of living forms. Unfortunately these remarkable chimæroids lived under conditions unfavorable to their preservation as fossils, so that they are known to us only from fragmentary remains — dental plates and fin-spines. And upon these elements alone the morphology and evolution of the group in the Cretaceous must, for the present at least, be based.

Two reviews of Cretaceous chimæroids, both dealing chiefly with European forms, have been published. E. T. Newton's classic memoir 'Chimæroid Fishes of the British Cretaceous Rocks,' appeared in 1878 [22], and Dr. A. S. Woodward's revision in his 'Catalogue of the Fossil Fishes in the British Museum,' in 1891 [27]. In the following pages the American forms are reviewed, upon the collection in the American Museum of Natural History as a basis. This collection includes nearly all of Cope's types, without which, indeed, this review would have been impossible. It may be mentioned that this is the first of several reviews, of groups of fossil fishes extensively represented in the American Museum collections, which the writer has planned. They are intended as contributions toward a revised check list of American fossil fishes. Such a check list, in which every item has been carefully scrutinized, is indispensable as a basis for all studies on the evolution, the migration and the geological range of the American fish faunas.

The determination of species of chimæroid dental plates is very difficult, owing to their wide range of variation due to age, sex and other circumstances. All who have dealt with this group have found the same difficulty. E. T. Newton, for instance, in his discussion of the British forms, says respecting one species: "Examination of a large series of specimens has shown that *Edaphodon sedgwickii* varies very considerably in the form and size of its teeth; so much is this the case that at first I was inclined to regard some of them as distinct species; gradation of intermediate forms, however, compels me to regard them as merely varieties." [22, p. 8.] And Professor Bashford Dean, writing of the dental plates of living forms, says: "Considerable judgment is necessary to determine accurately species of chimæroids when dental plates alone can be studied, *e. g.*, in the case of many fossil forms. Indeed, with so wide a range of variation, it is quite conceivable that *Chimæra colliei*, if known only by its dental plates, might be described under several species, and possibly two genera." [9, p. 20.]

In judging the validity of species, in the following pages, I have tried to evaluate all the characters — to separate those which may be due to age, sex or individual variation, from those which may be regarded as specific. Each species has been carefully considered; and more satisfactory results are hardly to be expected, except with the accumulation of much new material.

HISTORICAL REVIEW.

Dental plates of chimæroids must have been known in Europe, and especially in England where they occur in the Chalk formations, from times immemorial. But their nature was long not understood: they were regarded as the beaks of turtles or the teeth of reptiles [2]. Their true relationship was discovered by William Buckland, in 1835, who compared them with the bones of various fishes and other animals, and at length recognized their resemblance to the dental plates of *Chimæra*. He read a paper on the subject before the Geological Society of London (first published in 1836 [2]); and his view was at once accepted by Louis Agassiz [2, p. 6].

In America, the earliest reference to fossil chimæroids occurs in a paper by Richard Harlan, published in 1835. He figured a dental plate, which had been found with some sharks' teeth and reptilian vertebræ in New Jersey, and believed it to be the tooth of a reptile — this was before the nature of these dental plates had yet been made out. His figure clearly represents the anterior half of an *Edaphodon* mandibular [14].

The first description of an American fossil chimæroid was published by Leidy, in 1856 [18]. He based a new species, *Edaphodon mirificus*, upon eight upper and lower "maxillary plates." That he appreciated the real nature of these elements is evident from the fact that he referred this material to *Edaphodon.*

Subsequent discoveries in America have resulted in the description of other species of Cretaceous chimæroids — by Cope in 1869 [5, 6, 7]; Marsh, 1870 [21]; and Leidy, 1873 [19]. The number of American forms at present on record is twenty-one, representing nine genera. A list of these is given in the following table.

Original Names Proposed by Authors for American Cretaceous Chimæroids.

Original Name	Author	Type	Page
Bryactinus amorphus	Cope, 1875	Small fragmentary dental plate......	223
Diphrissa latidens	" 1875	Imperfect left mandibular...........	211
" *solidulus*	" 1869	Left mandibular..................	210
Dipristis meirsii	Marsh, 1869	Large dorsal fin-spine...............	207
Edaphodon mirificus	Leidy, 1856	Eight dental plates................	204
Eumylodus laqueatus	" 1873	Left vomerine.....................	217
Ischyodus divaricatus	Cope, 1869	Right mandibular.................	210
" *fecundus*	" 1875	Eight mandibulars................	208
" *gaskillii*	" 1875	Small left mandibular..............	206
" *incrassatus*	" 1875	Imperfect right mandibular..........	207
" *laterigerus*	" 1869	Left mandibular..................	211
" *longirostris*	" 1875	One mandibular and one palatal......	208
" *monolophus*	" 1869	Right and left mandibulars of different fish.......................	208
" *smockii*	" 1869	Several mandibulars...............	213
" *stenobryus*	" 1875	Pair of mandibulars...............	213
" *tripartitus*	" 1875	Pair of mandibulars and a left palatal..	215
Isotænia neocæsariensis	" 1875	Left palatal......................	222
Leptomylus cookii	" 1870	Right mandibular.................	219
" *densus*	" 1869	One mandibular and one palatal......	218
" *forfex*	" 1875	Right mandibular.................	221
Sphagepœa aciculata	" 1869	Small spine.......................	224

Several writers have shown the necessity for changes in some of these names. A. S. Woodward [27, p. 84] has pointed out, that the species ascribed by Cope to *Ischyodus* belong in *Edaphodon*, Cope having confused the definitions of the two genera. Hay has shown [15, p. 324] that Leidy's *Eumylodus* belongs in *Edaphodon*.

In 1908, the writer published a preliminary review of these forms in his 'Catalogue of Types and Figured Specimens' [16, pp. 37–41], and figured Cope's types which up to then had remained unillustrated. Several of Cope's species, also, were shown to be mere synonyms.

In 1911, Henry W. Fowler, in a review of the Cretaceous and Eocene fishes of New Jersey, republished the original descriptions of the chimæroids of that State, and gave valuable data on the geological horizons of the different species. He also illustrated some of Leidy's types which had remained unfigured.

CORRELATION OF THE CRETACEOUS CHIMÆROID HORIZONS OF AMERICA AND WESTERN EUROPE.

There are three localities in America from which Cretaceous chimæroids have been obtained: New Jersey, Mississippi and Wyoming (map, Fig. 1). All are of upper Cretaceous age. The first has yielded the greater number of forms, the others only one each.

The stratigraphy and correlation of the American Cretaceous have been studied by a number of authors, more especially by Charles A. White, 1891, [26], Stuart Weller, 1907, [25], Kümmel, 1911, [17], and Schuchert, 1910, [24]. The exhaustive study of the faunas of the Atlantic and Gulf borders by Stuart Weller, has demonstrated that these formations are divisible into two horizons: a lower, *Ripleyan*, which occurs in the entire Atlantic and Gulf borders; and an upper, *Jerseyan*, which is best developed in New Jersey, and gradually thins out and disappears south of Maryland. The upper, or *Jerseyan* division, is correlated by Weller with the *Danian* of Europe, more especially, with the Maestricht division of the *Danian*. The lower, or *Ripleyan*, he correlates with the *Senonian*. The chimæroids from New Jersey, occurring as they do in the *Jerseyan* formation, are of Danian age. In Europe, on the other hand, Cretaceous chimæroids are unknown later than the Senonian.

The following table of Cretaceous horizons in New Jersey shows the stratigraphical range of the American chimæroids, and their time relations to European forms.

Correlation of Upper Cretaceous of America (Atlantic Border) and Western Europe.[1]

America			Europe	Chimæroids	
				America	Europe
Jerseyan	Manasquan marl	20′–30′	= Danian (Mæstricht division)	*Edaphodon* *Leptomylus* *Isotænia*	
	Vincentown sand	25′–70′			
	Hornerstown marl	30′			
Ripleyan	Tinton bed	10′–20′	= Senonian		*Ischyodus* *Edaphodon* *Elasmodus* *Elasmodectes*
	Red Bank sand	0′–100′			
	Navesink marl	25′–40′			
	Mount Laurel sand Wenonah sands	40′–80′			
	Marshalltown clay	30′–35′			
	Englishtown sand	30′–100′			
	Woodbury clay	50′			
	Merchantville clay	60′			
	Magothy formation (including Cliffewood clay)	25′–50′			
	Raritan formation	150′–250′	= Albian		*Ischyodus* *Edaphodon*

In the earlier records the chimæroid horizons of New Jersey are usually given as "Greensand No. 5." In the present classification this is equivalent to subdivision K of the Hornerstown marl [11, p. 112]. One or two chimæroids have been found at Birmingham and at Hurffville, New Jersey. At these localities the Hornerstown marl rests directly upon the Navesink with which it forms a continuous bed. It is possible, therefore, that at these localities the chimæroids are from the Navesink, and not from the Hornerstown; by analogy with the other species, however, this seems improbable, and all the New Jersey chimæroids may, provisionally at least, be referred to the Hornerstown.

The following table gives the geological range of the European and American Cretaceous chimæroids so far as at present known.

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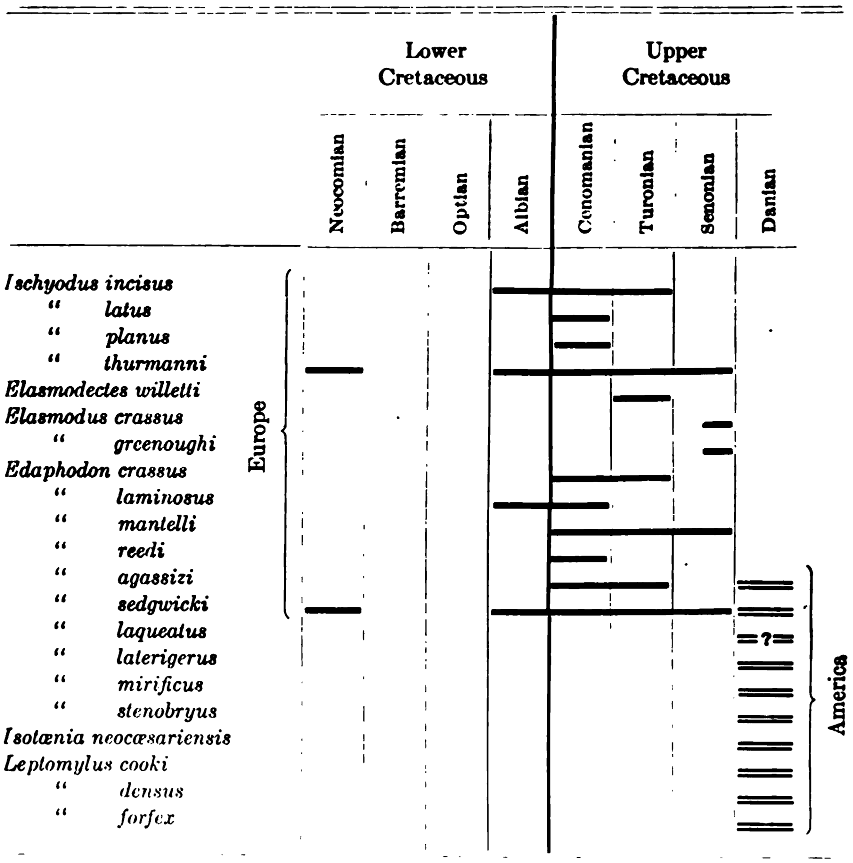
[1] The stratigraphic subdivisions are according to Stuart Weller [25]; the thicknesses, according to Kümmel [17].

Geological Range of Cretaceous Chimæroids on Both Sides of the Atlantic.



This table brings out the following points:

1. Only two species of chimæroids are common to the Cretaceous of Europe and America — *Edaphodon agassizi* and *E. sedgwicki.*
2. The dominant genera in the European Cretaceous are *Ischyodus* and *Edaphodon;* in the American, *Edaphodon* and *Leptomylus.*
3. In Europe no chimæroids are known from the final stage (Danian) of the Cretaceous, whereas in America they are known almost exclusively from this horizon.[1] From this it appears that condi-

---

[1] The only American form whose horizon is doubtful is *Edaphodon* (*Eumylodus*) *laqueatus* Leidy, which is probably of Senonian age since at the locality where it was found (near Columbus, Mississippi), the uppermost division of the Cretaceous appears to be absent.

tions especially favorable for chimæroid life developed on the American coast later than on the European; that is, with the gradual subsidence of the coast line and the consequent deepening of the American sea, toward the close of the Cretaceous. The center of chimæroid radiation appears then to have shifted from Europe to America.

In connection with the distribution of Cretaceous chimæroids, it is worth noting that no species are at present known from the southern hemisphere, although the group was doubtless represented, since chimæroids occur in the tertiary formations of Australia and New Zealand. A species of *Edaphodon* has been recorded from Amuri Bluff, New Zealand [22, p. 31], and credited to the Cretaceous; but it really belongs in early tertiary times, as has recently been strongly maintained by Chapman and Pritchard. They say: "It is unfortunate that reference to the Amuri

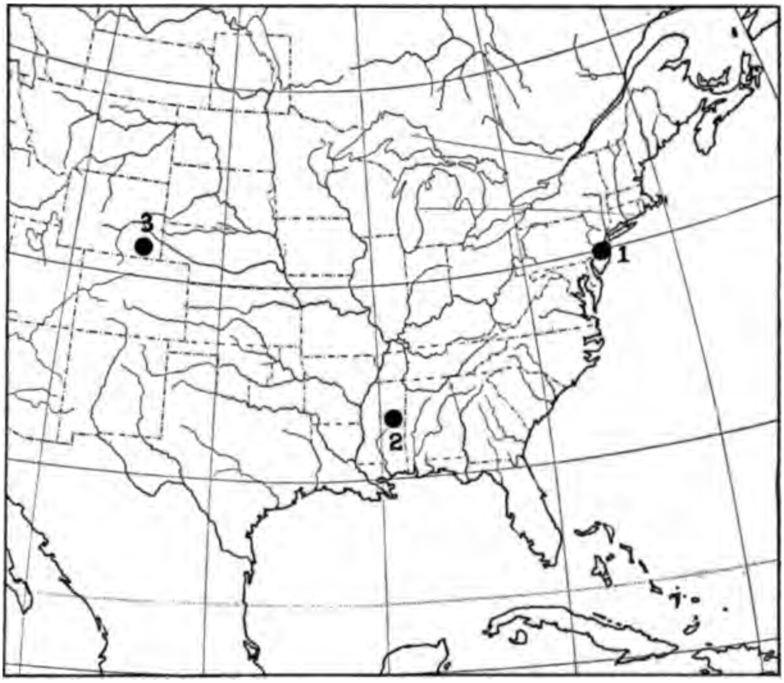


Fig. 1. Map showing American localities from which Cretaceous chimæroids have been obtained.

1. New Jersey: *Edaphodon, Leptomylus, Isotænia.*
2. Near Columbus, Mississippi: *Edaphodon (Eumylodus).*
3. Near Laramie, Wyoming: Egg-case of a chimæroid.

Bluff deposits as Greensand should have been made and perpetuated, considering that the fauna is so distinctly tertiary." [4, p. 64.]

SYSTEMATIC REVISION.

Genus **Edaphodon** *Buckland.*

Edaphodon BUCKLAND, Proc. Geol. Soc. London, II, 1838, p. 687.

Passalodon BUCKLAND, Proc. Geol. Soc. Lond., II, 1838, p. 687. No description. (Name applied to vomerines only.)

Psittacodon AGASSIZ, Poiss. Foss., III, 1843, pp. 340, 348. (Name applied to mandibulars only.)

Dipristis MARSH, Proc. Amer. Assoc. Adv. Sci., 1869, p. 230. (Spine only.)

Diphrissa COPE, Proc. Amer. Philos. Soc., XI, 1869, p. 244. (Mandibular only.)

Eumylodus LEIDY, Rept. U. S. Geol. Surv. Terr., I, 1873, p. 309.

Bryactinus COPE, Vert. Cret. Formations West, 1875, p. 282. (Fragment of a vomerine.)

A genus known only from dental plates and dorsal fin-spines. Type species, *Edaphodon bucklandi* Agassiz.

Dental plates, large, massive, in natural association suggestive of a bird's beak; composed of a pair of mandibular, a pair of vomerine, and a pair of palatal elements.

Mandibular, beak-like and more or less laterally compressed anteriorly; posteriorly, expanded upward and outward. No definite thickening on outer face. Symphyseal facet broad, extending $\frac{1}{3}$ to $\frac{3}{4}$ the length of the mandibular and varying from $\frac{1}{5}$ to the entire depth of the inner aspect of the beak. Tritors usually four in number: a small one (sometimes two) at tip of beak; one very large tritor (the "median") occupying the inner posterior half of the tooth; and two smaller tritors, along the outer margin, one situated near middle of tooth, the other a short distance posterior to it.

Palatal, subtriangular when viewed from oral face. Upper surface with a deep, broad, longitudinal furrow, which extends almost to the anterior margin of the tooth. Symphyseal face smooth and almost vertical; lateral face sloping outward and downward. Tritors large, three in number: two along the symphyseal margin one behind the other; and one situated in the postero-external angle of the tooth.

Vomerine, triangular in side view. A row of tritors along the biting edge, on the inner side of the element, extending to the upper surface of the tooth.

Fin-spines, large, gently arcuate, and laterally compressed. Anterior margin with a sharp keel; posterior, with a double row of small, sharp, downward-pointing denticles. Lateral faces with faint longitudinal striations.

Fifteen species of *Edaphodon* have been described from the Upper Cretaceous of North America, but only six are valid, the others being referable to them (Fig. 2). These six species are:

1. *Edaphodon mirificus* Leidy.
2. “ *laterigerus* (Cope).
3. “ *stenobryus* “
4. “ *agassizi* (Buckland).
5. “ *sedgwicki* (Agassiz).
6. “ *laqueatus* (Leidy).

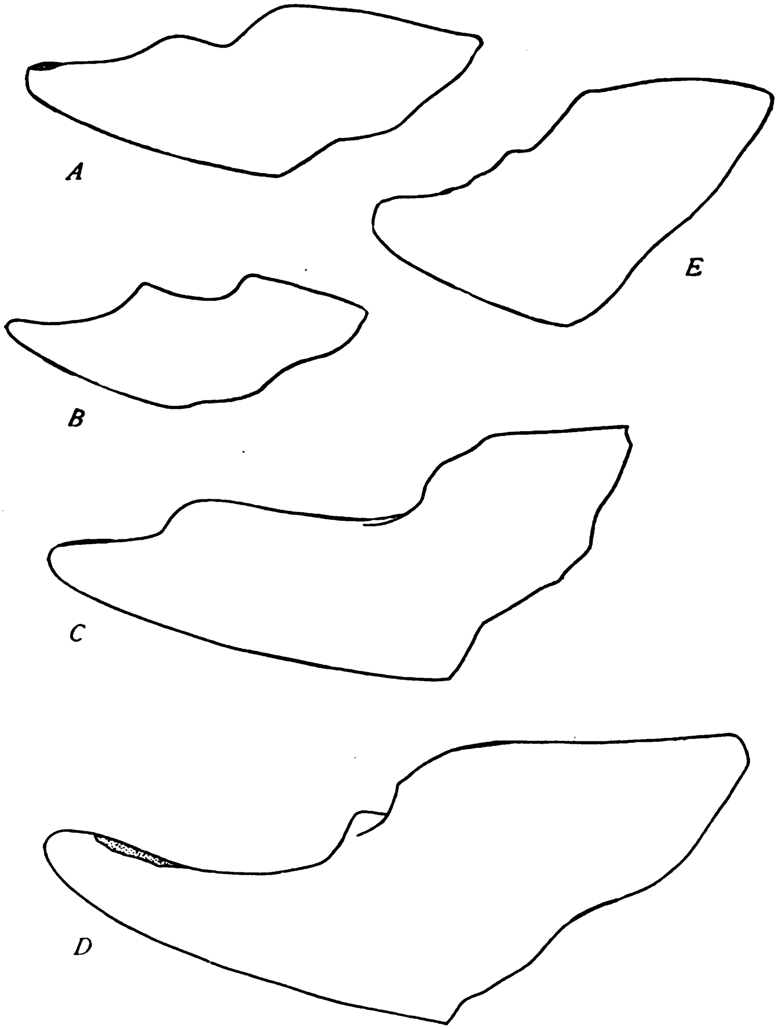


Fig. 2. Diagram-key to the American species of *Edaphodon* of which the mandibular is known. Left mandibulars in outer view. × ½.

A, *Edaphodon mirificus* Leidy; **B**, *E. agassizi* (Buckland); **C**, *E. laterigerus* (Cope); **D**, *E. sedgwicki* (Agassiz); **E**, *E. stenobryus* (Cope).

Edaphodon mirificus *Leidy.*

1856. *Edaphodon mirificus* LEIDY, Proc. Acad. Nat. Sci. Phila., VIII, p. 221.

1869. *Ischyodus mirificus* Leidy, COPE, Proc. Bost. Soc. Nat. Hist., XII, p 314.

1869. *Ischyodus monolophus* COPE, *Ibid.*, p. 314.

1869. *Diphrissa solidulus* COPE, Proc. Amer. Philos. Soc., XI, p. 244.

1869. *Dipristis meirsii* MARSH, Proc. Amer. Assoc. Adv. Sci., 18th meeting, p. 230. (Fin-spine only.)

1873. *Edaphodon mirificus* LEIDY, Rep. U. S. Geol. Surv. Terr., I, p. 306; pl. xxxvii, figs. 6–12.

1875. *Ischyodus mirificus* COPE, Vert. Cret. Format. West, p. 291.

1875. *Diphrissa latidens* COPE, *Ibid.*, p. 283.

1875. *Ischyodus longirostris* COPE, *Ibid.*, p. 287.

1875. *Ischyodus incrassatus* COPE, *Ibid.*, p. 289.

1875. *Ischyodus gaskillii* COPE, *Ibid.*, p. 290. (Juvenile mandibular.)

1875. *Ischyodus fecundus* COPE, *Ibid.*, p. 290.

1875. *Ischyodus miersii* (Marsh) COPE, *Ibid.* p. 292. (Fragmentary spine and mandibular.)

1878. *Edaphodon mirificus* Leidy, NEWTON, Chim. Fishes Brit. Cret. Rocks, p. 24.

1908. *Edaphodon mirificus* Leidy, HUSSAKOF, Bull. Amer. Mus. Nat. Hist., XXV, p. 38, pl. ii, fig. 3.

1911. *Edaphodon mirificus* Leidy, FOWLER, Geol Surv. N. J , Bull 4, p. 121, figs. 72–75. (Figures of the type specimens.)

Type.— Eight mandibular and palatal teeth. In the collections of the Academy of Natural Sciences, Philadelphia.

Horizon and *locality.*— Jerseyan, probably "Hornerstown K." (The Jerseyan = Danian of Europe). Hornerstown, New Jersey.

This species is known from the dentition and from fragments of dorsal fin-spines, and may be defined as follows:

Mandibular (Fig. 3), over twice as long as deep; its anterior half, in outer view, gradually tapering anteriorward; tritoral prominence at middle of oral margin either present or absent. Middle portion of outer surface concave in the longitudinal axis of tooth. Symphyseal facet, which is usually a smooth, flat area ½ to 1 centimeter wide, and rarely only a line, extends over half the length of the tooth. Tritors four: a small one, sometimes elongated into a narrow band, at tip of tooth; one very large inner tritor and two smaller outer tritors.

Palatal, relatively massive, and more or less triangular when viewed from oral face. A broad furrow, which deepens anteriorward, extends from the posterior margin of tooth to within a short distance of its anterior edge. Externo-lateral face of tooth sloping downward from the outer edge of the furrow. Tritors three: two inner and one outer. Anteriormost tritor begins back of anterior edge of tooth, a distance equal to ⅓ or ½ the length of the tooth. Posterior inner tritor the largest.

Vomerines, similar to those of other species, differing only in trivial characters. Eight tritors along oral edge; the four nearest the symphysis long and slender, the next three somewhat shorter, the eighth and last, relatively large and oval. These tritors extend up through the element to its dorsal margin.

This is the most common American Cretaceous chimæroid. Over half the dental plates in collections belong to it; and to it, also, should be referred at least eight of the forms which have been described as distinct species. Most of these were based on single elements, some on even fragmentary or juvenile ones, and one (*meirsi*) on a fin-spine. All these "species" intergrade nicely, forming an unbroken series from the small form, "divaricatus," to the large, senile form, "incrassatus." The range of variation in this series is not greater than in the materials of *Edaphodon sedgwicki* in the British Museum, which I had the opportunity of examin-

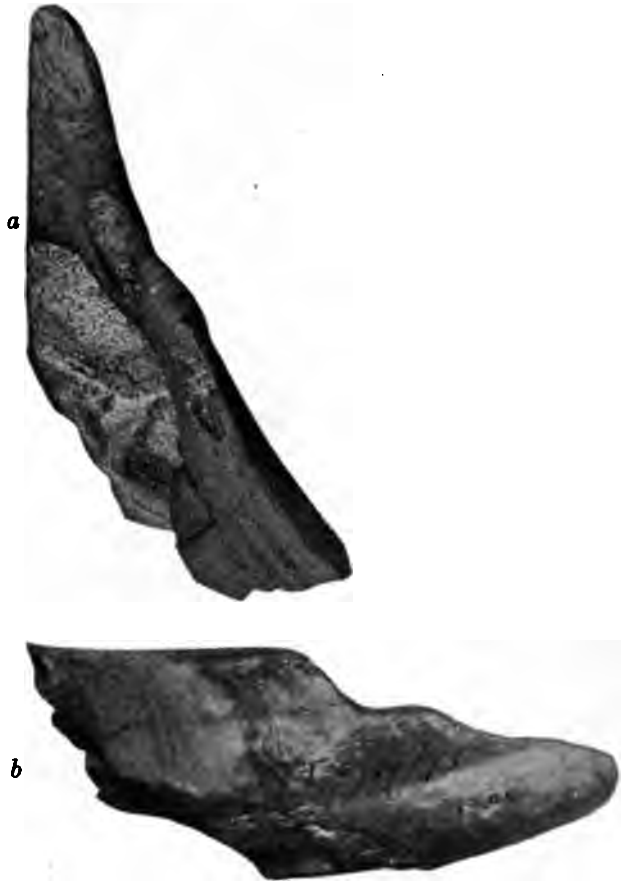


Fig. 3. *Edaphodon mirificus* Leidy. Right mandibular, in oral (*a*), and outer (*b*), views. No. 7206 Amer. Mus. × ¾.

ing, in 1909. A detailed discussion of the forms referred to *E. mirificus* is given below.

The mandibular and palatal elements of *Edaphodon mirificus* have been so carefully described and figured by Leidy [19] that little need here be said regarding them; one small point only should be referred to. From Leidy's figures [19, pl. xxxvii, figs. 6, 7], it might appear that the mandibular was devoid of any tritoral prominence. A comparison of a number of specimens shows, however, that the prominence is generally present; and that its size depends upon the degree of development of the anterior outer tritor, and, like it, is very variable. It is not well developed in the specimen figured by Leidy; but it is well shown in several specimens in the Cope collection, particularly so in a beautifully preserved right mandibular, No. 7206.

The vomerines of *E. mirificus* were unknown to Leidy and are here figured from a pair in the Cope collection in the American Museum (Fig. 4). They were found associated with the rest of a dentition of this species, and probably belong with it. Their characters are summarized in the diagnostic description given above.

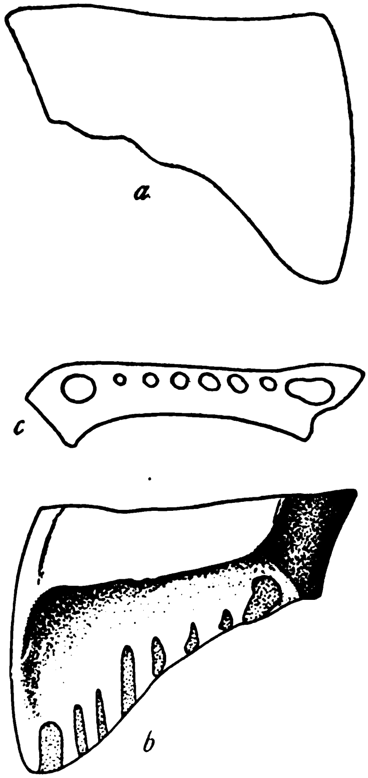


Fig. 4. *Edaphodon mirificus* Leidy. Right vomerine, in outer (*a*), inner (*b*), and top (*c*), views. No. 2223 Amer. Mus. × ½.

Notes on the Species referred to E. mirificus.

1. *Edaphodon* "gaskillii" (Cope) [Plate XIX, fig. 3 and text-fig. 6, *A*].—This supposed species was based on an imperfect left mandibular (No. 7196, Amer. Mus.), which, as I have already shown [16, p. 38], represents a young individual of *E. mirificus*. The diagnosis of it was based on the size and position of the tritors; and these seem to be only variations, due to immaturity and individual peculiarities, of the characters shown in *E. mirificus*. Apart from these features, there are none of specific value. The

curvatures of the outer and of the inner margins of the oral face agree entirely with those of *E. mirificus.*

2. *Edaphodon* (*Dipristis*) "meirsii" Marsh.— In 1870 Marsh [21] described a large denticulated spine from the Upper Cretaceous of New Jersey, which he correctly identified as the dorsal fin-spine of a chimæroid, and named *Dipristis meirsi.* In 1875 Cope [8, p. 292] described a fragment of a similar spine which had been found associated with a mandibular; and as this mandibular belonged undoubtedly in *Edaphodon*,[1] he relegated the genus *Dipristis* to the synonymy of *Edaphodon.*

Marsh's type is preserved in the geological museum of Yale University, and through the kindness of Professor R. S. Lull, a photograph of it is here reproduced (Plate XX, fig. 1). It is seen at once that Cope's view was correct; that the spine named *Dipristis* is similar to that of *Edaphodon;* indeed, it is very like the spine of *Edaphodon agassizi* figured by Newton [22, pl. iii, fig. 3].

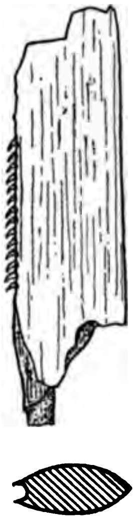


Fig. 5. Fragment of a chimæroid dorsal fin-spine of the form named *Dipristis meirsi* by Marsh; found associated with a mandibular of *Edaphodon mirificus.* No. 7202 Amer. Mus. Natural size.

Cope's specimen of this spine (Fig. 5) and its accompanying mandibular are preserved in the American Museum (No. 7202). The mandibular is identical with that of *Edaphodon mirificus,* the characters said by Cope to be peculiar to *E. meirsi* being only variations of those seen in *E. mirificus.* Hence *Dipristis* (*Edaphodon*) *meirsi* must be considered a synonym of *E. mirificus.*

3. *Edaphodon* "incrassatus" (Cope) [Plate XIX, figs. 8, 9; text-fig. 6, *D*]. — This species was based on an imperfect right mandibular (No. 2234 Am. Mus.), distinguished from that of *E. mirificus* by the greater thickness of the "beak." In other respects it is similar to *mirificus.* Another and larger right mandibular (Fig. 6, *E*), in the Cope collection (No. 7198) accompanied by both palatals, is comparable with Cope's *E. incrassatus.* It is even larger, heavier and thicker than the latter, the tritoral area is almost flat and half again as wide as in a typical *E. mirificus* mandibular. Nevertheless this tooth is so suggestive of the latter species, in arrangement of tritors, conformation of outer face, direction of oral and post-oral margins, that it should not be separated specifically. The pair of palatals associated

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[1] Through a confusion of definitions, Cope referred this spine to *Ischyodus,* not to *Edaphodon;* but it is obvious that he had the latter genus in mind.

with it, and presumably belonging to the same individual, differ from those of *E. mirificus* only in size and in some minor points. It seems probable that these heavy specimens represent senile individuals of *E. mirificus*, and that with age the dental plates of this species increased greatly in thickness without a corresponding increase in length. This is borne out by arranging a series of mandibulars leading from the smallest, slenderest form to the largest and presumably oldest form (Fig. 6).

4. *Edaphodon* "monolophus" (Cope).— A species founded by Cope in 1869 [5, p. 314] on right and left mandibulars (No. 2229 Am. Mus.) belonging to different fishes. The right mandibular is fragmentary, lacking both anterior and posterior portions including the second outer tritor; nevertheless there is no doubt of its identity with the same element in *E. mirificus*, from which it does not differ in any essential feature.

The left mandibular is more perfect and shows characters suggestive of both *E. mirificus* and *E.* "longirostris"; indeed it may be regarded as a gradation between the two.

5. *Edaphodon* "longirostris" (Cope) [Plate XIX, figs. 6, 7].—The types of this species were a mandibular (No. 2230 Amer. Mus.) and a palatal. The former differs from *E. mirificus* only in minor points. The "beak" is rather longer and narrower than is usual in *E. mirificus;* but the arrangement of tritors is exactly as in *mirificus*, except that the outer anterior one is situated "on a horizontal step, which forms a strong angle of the outer border. This border is, therefore, abruptly excavated from that point forward, while the inner border descends gradually from the inner angle." The symphyseal facet occupies about three-fourths the length of the entire element. On the whole its characters do not differentiate it from *E. mirificus*.

The palatal mentioned by Cope as accompanying the type mandibular is characterized by "the small size and posterior position of the anterior [tritoral] area, so that the bone appears to be more produced. The posterior areas are large." A palatal answering to this description is No. 2239, American Museum; but it is not certain that it is the identical one described by Cope; and on the whole there is doubt whether its characters are really of specific value.

6. *Edaphodon* "fecundus" (Cope) [Plate XIX, figs. 4, 5; Plate XX, figs. 2, 3; text-fig. 6, *B*].— The types of this species are seven mandibulars and one palatal (No. 2225 Amer. Mus.) from the Greensand at Hornerstown, New Jersey — probably Hornerstown "K." The mandibulars are not well-preserved, being weathered along the oral faces so that the tritoral areas are imperfectly delimited. Comparison of these elements with those of *E. mirificus*, especially the "*meirsii*" form, proves that they grade into the latter and cannot be separated specifically from it.

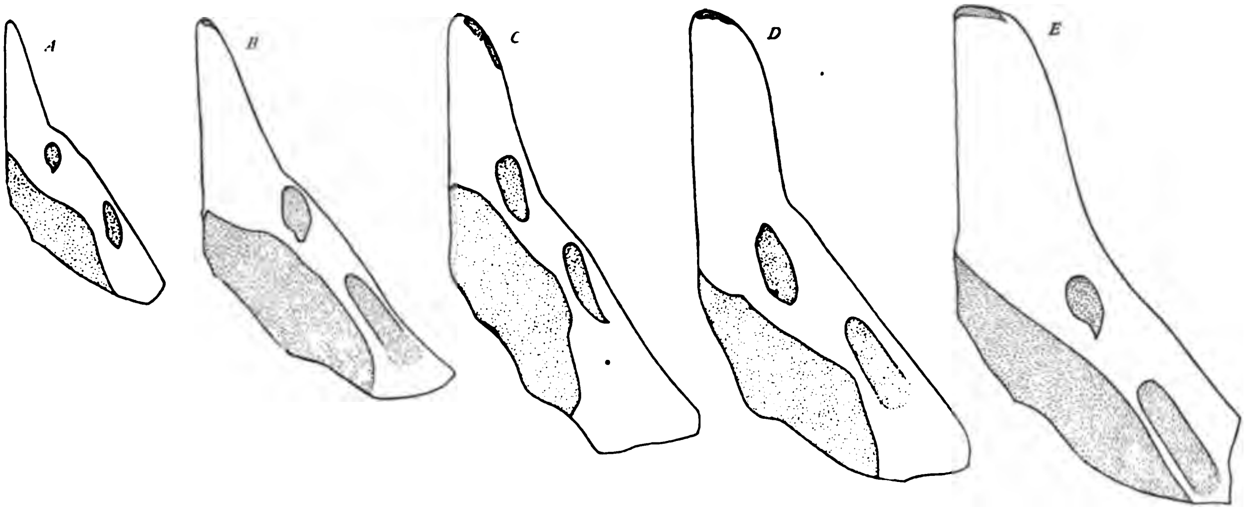

Fig. 6. Variations in the mandibular of *Edaphodon mirificus*, showing characters on which various supposed species have been based. × ½.

A, immature mandibular of the form described as *Edaphodon* "gaskilli" and *E.* "divaricatus"; **B**, *Edaphodon* "fecundus"; **C**, *Edaphodon mirificus*,' *E.* "monolophus"; **D**, *Edaphodon* "incrassatus"; **E**, a senile mandibular of the "incrassatus" variety (No. 7198 Amer. Mus.).

Cope's diagnosis was based chiefly on the size and form of the tritors — characters at present not regarded valid criteria of species. He mentions the fact that some of the eight type mandibulars are accompanied by "maxillary plates", *i. e.*, palatals. In the American Museum collection there are seven of these mandibulars and one palatal; and it is not entirely certain that the latter belongs with the mandibulars. The characters of the palatal as given by Cope are too general to be of value in separating species. He says: "The maxillaries [*i. e.*, palatals] are narrowed and truncate in front; the areas are large, especially the posterior. The superior groove is deep, and the outer face extensive and longitudinally ridged." This description would apply to the palatal of any species of *Edaphodon*.

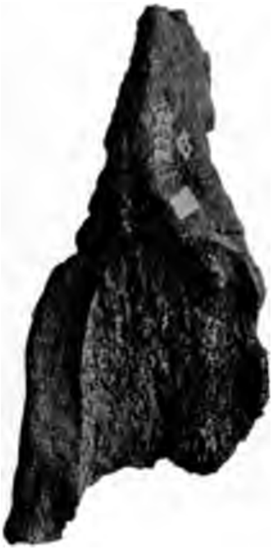

Fig. 7. *Edaphodon* "latidens" (Cope). Type mandibular in oral aspect. No. 2232 Amer. Mus. × ½.

7. *Edaphodon* "divaricatus" (Cope) [Fig. 6, *A*].— Founded upon a right mandibular preserved in the Museum of the Philadelphia Academy of Sciences [see Fowler, 11, p. 124, fig. 76]. Three mandibulars which Cope subsequently referred to this species are in the American Museum (No. 2229). A careful study of these referred specimens shows that they grade nicely into *E.* "fecundus"; and this form as shown above belongs in *E. mirificus*. The symphyseal facet of the mandibular is usually narrower in the "divaricatus" form than in typical *E. mirificus*; in one of Cope's three referred specimens, however, it is as broad as in *E. mirificus*. Other differences, such as the shape and the lateral arching of the oral face, may be passed over as variations rather than specific characters.

8. *Edaphodon* (*Diphrissa*) "solidulus" (Cope) [Plate XIX, figs. 1, 2].— This genus and species were founded on a unique left mandibular (7193 Amer. Mus.), which is smaller than that of *E. mirificus*, resembling, in this regard, the mandibulars of *Edaphodon* "divaricatus," with which it agrees almost exactly in other regards. The type is hardly distinguishable from a mandibular of *E.* "divaricatus" in the American Museum collection (one of three mandibulars, No. 2229). Concerning this form Cope wrote:

"This species is nearest the *I.* [*Edaphodon*] *divaricatus* m. It differs in many respects, among which are the absence of anterior outer [tritoral] area, and of prominence of the inner lip, and the greater reduction of the terminal column. Its lack of dental development allies it to the *Leptomylus* m." [6, p. 244.]

Whence it appears that the only differences Cope found between this mandibular and that of *E. divaricatus* were in the tritors and oral configuration; and these features, as shown above (p. 196) are not important enough to warrant specific separation.

9. *Edaphodon* (*Diphrissa*) "latidens" Cope [Fig. 7].—The mandibular named by Cope *Diphrissa latidens,* I refer, with some hesitation, to *Edaphodon mirificus.* The type and only specimen is an imperfect left mandibular (No. 2232 Amer. Mus.). It is poorly preserved, the outer face having been almost completely weathered away; and the element has been much distorted by vertical and lateral pressure, so that the oral surface has become flattened out in the region of the tritors and distorted anteriorly. None the less this dental plate has considerable resemblance to the "divaricatus" variety of *E. mirificus*; and it seems best to refer it to that genus and species.

Edaphodon laterigerus (*Cope*).

1869. *Ischyodus laterigerus* Cope, Proc. Amer. Philos. Soc., XI, p. 243.

1875. *Ischyodus laterigerus* Cope, Vert. Cret. West, pp. 284, 288.

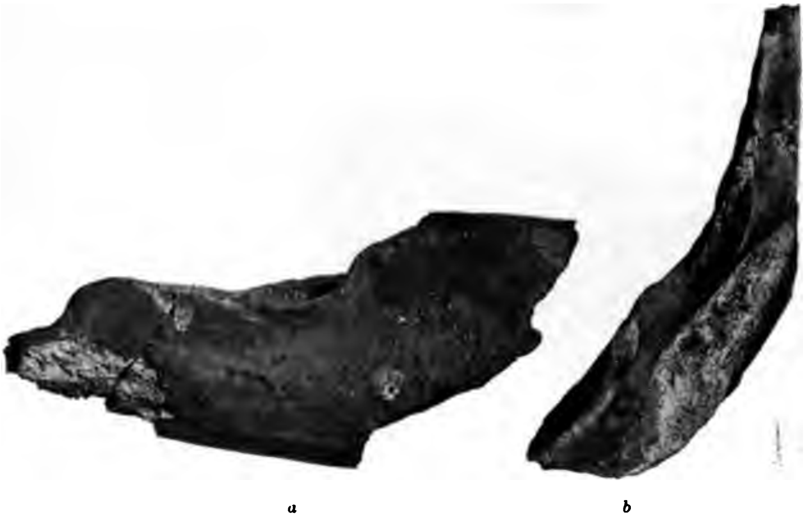

Fig. 8. *Edaphodon laterigerus* (Cope). Left mandibular in outer (*a*), and oral (*b*), views. Type, No. 2238 Amer. Mus. × ½.

1891. *Edaphodon laterigerus* (Cope) A. S. Woodward, Catal. Fos. Fishes, II, p. 85.

1908. *Edaphodon laterigerus* (Cope) Hussakof, Bull. Amer. Mus. Nat. Hist., XXV, p. 38, pl. i, figs. 7, 8.

1911. *Edaphodon laterigerus* (Cope) Fowler, Geol. Surv. N. J., Bull. 4, p. 113, fig. 65.

Type.— A left mandibular (Figs. 8, and 2, *C*). Cope collection, No. 2238 American Museum.

Horizon and *locality.*— Jerseyan, Hornerstown "K" (= Danian of Europe); Hornerstown, New Jersey.

This species is known only from the type specimen; but this offers such marked characters that there is no doubt of its specific validity.

Anterior portion of mandible elongated and laterally compressed. Symphyseal facet nearly half the length of entire element. Anterior outer tritor much elongated antero-posteriorly; posterior outer tritor small, suboval; inner tritor large, elongated, extending forward a distance equal to about three-fifths the length of the whole element, with its greatest width contained about two and one-half times in its total length. Tritoral prominence greatly elongated, presenting, in side view, an almost straight line, more than half the total length of the dental plate; at its anterior end this line curves downward, considerably in advance of the tritor. Oral face, in front of anterior tritors, occupied by a shallow depression which slopes gradually from the outer prominence to the symphysis. If the two mandibulars were placed in natural association, the anterior median portion of the "beak" would be, as noted by Cope, occupied by an elongated excavation walled in laterally by the two anterior outer prominences, and extending backward as far as the anterior termination of the tritors

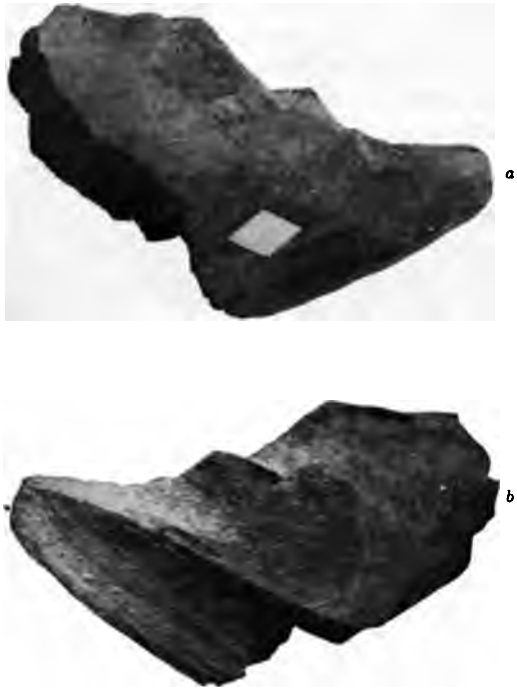

Fig. 9. *Edaphodon stenobryus* (Cope). Right mandibular in outer (*a*), and oral (*b*), views. Type. No. 7204 Amer. Mus. × ½.

Measurements of the Mandibular.

Total length of mandibular (slightly restored)	140 mm.
Depth in region of posterior outer tritor	68 "
Depth opposite middle of anterior outer tritor	40 "
Length of anterior outer tritor	43 "
Length of posterior outer tritor	17 "
Length of inner outer tritor	80 "

Edaphodon stenobryus (*Cope*).

1875. *Ischyodus stenobryus* COPE, Vert. Cret. West, p. 285.

1891. *Edaphodon stenobryus* (Cope) A. S. WOODWARD, Cat. Fos. Fishes, Part II, p. 85.

1908. *Edaphodon stenobryus* (Cope) HUSSAKOF, Bull. Amer. Mus., XXV, p. 39, pl. ii, figs. 6, 7.

1911. *Edaphodon stenobryus* (Cope) FOWLER, Geol. Surv. N. J., Bull. 4, p. 111, fig. 63.

Type.— A pair of mandibulars (Figs. 9, and 2 *E*). Cope Collection, No. 7204 American Museum.

Horizon and *locality.*— Jerseyan, probably Hornerstown "K" [= Danian of Europe]; Hornerstown, New Jersey.

A well-marked species distinguished by its form, height as compared with length, and by its lateral compression. As remarked by Cope, this species has considerable resemblance to *Leptomylus*, more so than any other species of *Edaphodon.*

Edaphodon agassizi (*Buckland*).

European Materials.

1835. *Chimæra agassizi* BUCKLAND, Proc. Geol. Soc. London, II, p. 206.

1843. *Ischyodus agassizi* (Buckland) EGERTON, Proc. Geol. Soc. London, IV, p. 156.

1843. *Chimæra* (*Ischyodus*) *agassizii* Buckland, AGASSIZ, Poiss. Foss., III, p. 341, pl. xl, *a*, figs. 3, 4, (?5); pl. xl, *c*, fig. 16.

1875. *Chimæra agassizii* Buckland, GEINITZ, Palæontogr., XX, p. 206, pl. xxxix, figs. 8–10.

1878. *Edaphodon agassizii* (Buckland) E. T. NEWTON, Chim. Fishes Brit. Cret. Rocks, p. 12, pl. iii.

1891. *Edaphodon agassizi* (Buckland) A. S. WOODWARD, Catal. Fos. Fishes Brit. Mus., II, p. 77.

American Materials.

1869. *Ischyodus smockii* COPE, Proc. Bost. Soc. Nat. Hist., XII, p. 316.

1875. *Ischyodus smockii* COPE, Vert. Cret. West, pp. 284, 288.

1891. *Edaphodon smockii* (Cope) A. S. WOODWARD, Catal. Fos. Fishes, II, p. 85.

1908. *Edaphodon smocki* (Cope) HUSSAKOF, Bull. Amer. Mus. Nat. Hist., XXV, p. 39, pl. ii, figs. 4, 5.

1911. *Edaphodon smockii* (Cope) FOWLER, Geol. Surv. N. J., Bull. 4, p. 115, fig. 66.

Horizon and *locality.*— Jerseyan, probably Hornerstown "K" [= Danian of Europe]; Hornerstown, New Jersey.

The three mandibulars on which Cope based his *Ischyodus smockii* are preserved in the American Museum (No. 7192). They differ from all other American species by the presence of very large angulated oral prominences which appear like steps in outer view (Figs. 10, and 2, *B*). These angulations vary with age from 90° to 105°. On comparing these mandibulars with the accounts of European species it is found that they agree with the description and figures of *Edaphodon agassizi* (Buckland); indeed, the figures of this species given by Newton [22, pl. iii, figs. 4, 5] might almost have been drawn from Cope's types of *I. smocki*. It appears, therefore, that *Ischyodus smockii* Cope must be considered a synonym of *Edaphodon agassizi* (Buckland). This species and *E. sedgwicki* (= *E. tripartitus* Cope), are the two European species represented in the Upper Cretaceous of America.

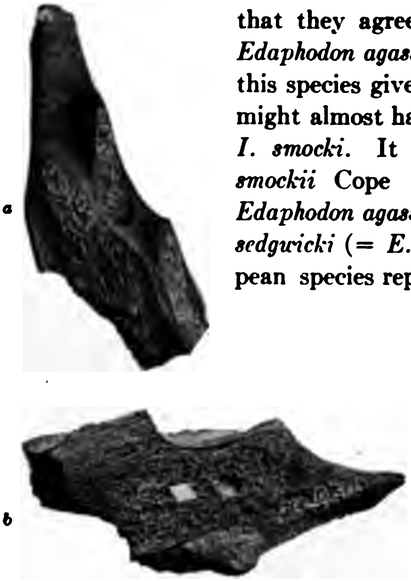

Fig 10. *Edaphodon agassizi* (Buckland). Right mandibular in oral (*a*), and outer (*b*), views. One of the co-types of *E.* "smockii" (Cope). No. 7192 Amer. Mus. × ½.

The mandibular of this species resembles to some extent that of *E. laterigerus* Cope: the tritors show a similar tendency to become elongated, and there are "steps," in outer view. Nevertheless the two species are undoubtedly distinct. *E. laterigerus* is much larger, the beak is greatly compressed and elongated, whereas in *E. agassizi* (*smocki*) it is abbreviated. In the former the anterior marginal prominence ("step") is rounded at the angle, whereas in the latter it is sharp.

A pair of well-preserved palatals of this species are also in the Cope collection (No. 7194 Amer. Mus.). They were found associated with mandibulars so that it seems reasonably certain that they belong to this species. Their form, in oral aspect, and the size and arrangement of the tritors is shown in Fig. 11. These palatals are relatively wide and shallow, grooved along the dorsal surface; the groove occupying about two-thirds of the width of the upper surface. The lateral walls of the elements do not converge rapidly anteriorly.

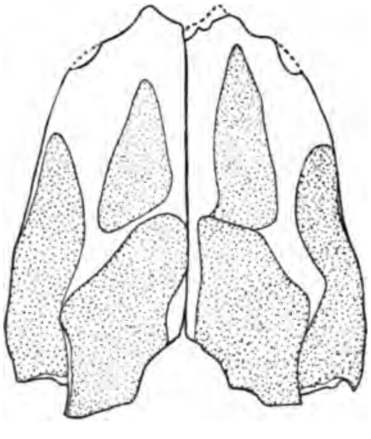

Fig. 11. *Edaphodon agassizi* (Buckland). Pair of palatal elements in oral aspect. No. 7194 Amer. Mus. × ½.

Measurements.

Length of right palatal	80 mm.
Width of tritoral surface, at middle of element	27 "
Depth at anterior extremity of outer tritor	17 "

Edaphodon sedgwicki (*Agassiz*).

European Materials.

1843. *Chimæra (Psittacodon) sedgwickii* AGASSIZ, Poiss. Foss., III, p. 349, pl. xl, figs. 17, 18.

1843. *Ischyodus sedgwicki* (Agassiz) EGERTON, Proc. Geol. Soc. London, IV, p. 156.

1847. *Edaphodon sedgwicki* (Agassiz) EGERTON, Quart. Journ. Geol. Soc., III, p. 352.

1878. *Edaphodon sedgwickii* (Agassiz) NEWTON, Chim. Fishes Brit. Cret. Rocks, p. 7, pl. i, ii.

1901. *Edaphodon sedgwicki* (Agassiz) WOODWARD, Catal. Foss. Fishes Brit. Mus., II, p. 73.

1906. *Edaphodon sedgwicki* (Agassiz) LERICHE, Poiss. Crét. du Nord de la France, p. 52.

American Materials.

1875. *Ischyodus tripartitus* COPE, Vert. Cret. Formations West, p. 286.

1891. *Edaphodon tripartitus* (Cope) WOODWARD, Catal. Fos. Fishes Brit. Mus., II, p. 85.

1908. *Edaphodon tripartitus* (Cope) HUSSAKOF, Bull. Amer. Mus. Nat. Hist., XXV, p. 40, pl. iii, figs. 5, 6.

1911. *Edaphodon tripartitus* (Cope) FOWLER, Geol. Surv. N. J., Bull. 4, p. 112, fig. 64.

Horizon and *locality.*— Jerseyan [= Danian of Europe]; Hurffville, New Jersey.

It has long seemed doubtful to me whether *Edaphodon tripartitus* (Cope) should stand as a distinct species, or be merged in *Edaphodon sedgwicki* Agassiz. Considering all the evidence, it appears that the two should be merged. Cope's types of *E. tripartitus* (Figs. 12, and 2, *D*) were a pair of mandibles and a left palatal (Cope collection, No. 2224 Amer. Mus.). On going over the descriptions of *Edaphodon sedgwickii* given by Newton [22, p. 7] with one of Cope's specimens of *E. tripartitus* in hand, it is seen that there is hardly a character mentioned in the description which is not to be found in this mandibular. Cope's types resemble figures 1 and 2 of Newton's illustrations of *E. sedgwickii* [22, pl. ii]; but it should be borne in mind that the mandibulars of *E. sedgwicki*, as pointed out by Newton, are exceedingly variable, and an exact correspondence between the American form and the European specimens he figures is hardly to be expected. Cope mentions the fact that the median tritor of his *E. tripartitus* is divided into three parts. This agrees with the European species in which the large median tritor is made up of two, and sometimes even of several, divisions.

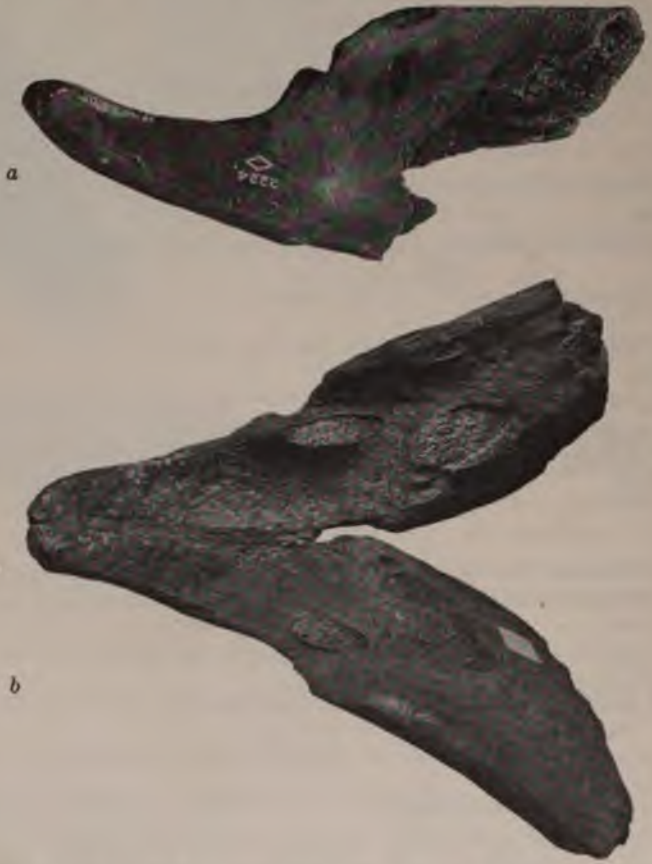

Fig. 12. *Edaphodon sedgwicki* (Agassiz). Left mandibular in outer view (*a*), and both mandibulars in oral view (*b*). Types of *E.* "tripartitus" (Cope). No. 2224 Amer. Mus. × ½.

The palatal element associated in the Cope collection with the mandibulars of *E. tripartitus,* differs somewhat in shape from the palatals figured by Newton [22, pl. ii, figs. 12, 13]; but there is no certainty that this palatal belonged with these mandibulars; it may be of a different species.

Edaphodon laqueatus (*Leidy*).[1]

1873. *Eumylodus laqueatus* LEIDY, Extinct Vert. Fauna W. Terr., p. 309, pl. xix, figs. 21, 22; pl. xxxvii, figs. 13, 14.

1875. *Eumylodus laqueatus* Leidy, COPE, Vert. Cret. Form. West, p. 282.

1891. *Edaphodon laqueatus* (Leidy) WOODWARD, Catal. Fos. Fishes Brit. Mus., II, p. 86.

1902. *Edaphodon laqueatus* (Leidy) HAY, Bull. U. S. Geol. Surv., No. 179, p. 324.

Type.— Right vomerine (Fig. 13). No. 5324, Philadelphia Academy of Natural Sciences.

Horizon and *locality.*— Cretaceous sandstone [? = Senonian of Europe]; near Columbus, Mississippi.

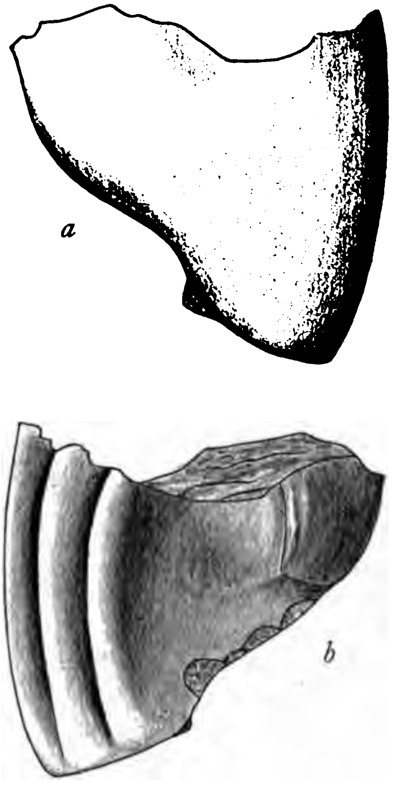

Fig. 13. *Edaphodon laqueatus* (Leidy). Right vomerine in outer (*a*), and inner (*b*.) views. Type of *Eumylodus laqueatus* Leidy, No. 5324 Acad. Nat. Sci. Philadelphia. × ⅔.

The type is the only element of this species known. It undoubtedly belongs in the genus *Edaphodon*, as was long ago pointed out by Woodward [27, p. 86], and not in a distinct genus. In trivial characters this vomerine differs from all others yet known, and must be retained, for the present at least, as a distinct species. Its chief characters are shown in Fig. 13. The salient parts of Leidy's description of it may here be quoted:

"The outer surface is nearly flat, but slightly depressed below, and bent outwardly behind from the triturating surface. The inner surface is fluted; the anterior third presents a succession of three curved ridges separated by two grooves; the median third forms a wide, concave groove; and the posterior third forms a nearly square plane, sloping from the triturating surface backward and inward, and defined by a subacute border from the outer surface of the bone."

Leidy speaks of three tritors along the cutting edge, but four are present, the very small, lowermost one having been apparently overlooked.

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[1] I am indebted to Dr. Witmer Stone for very kindly having permitted me to study the type of this species, which is in the collections of the Academy of Natural Sciences, Philadelphia.

Genus **Leptomylus** *Cope.*

Leptomylus Cope, Proc. Boston Soc. Nat. Hist., XII, 1869, p. 313.

A genus of chimæroids known only from mandibular elements, founded on *Leptomylus densus* as the type species. Its distinguishing character is the presence of only a single tritor on the oral face of the mandibular, instead of the four or more in *Edaphodon* and *Ischyodus*. The type species has never been figured and the whereabouts of the type specimen is unknown. Two other species, however,— *L. cooki* and *L. forfex* — referred by Cope to this genus, are available for study and these are described and illustrated in the following pages. *Leptomylus forfex* illustrates especially well the characters of the genus. From it one sees that *Leptomylus* represents a stage leading from the Edaphodonts, with typical crushing dentition, to the more modern type of chimæroid with typical cutting-and-biting dentition. In the mandibular the outer oral margin has risen above the rest of the oral surface into a sharp cutting edge. And concommitantly with this change the tritors, which functioned in attrition, have become reduced to a single small area. However, on account of its large size, *Leptomylus* cannot be regarded as the connecting form leading from *Ischyodus* and *Edaphodon* to the modern chimæroids such as *Callorhynchus;* the transition was probably through forms like *Elasmodus* and *Elasmodectes*. But *Leptomylus* represents an interesting side branch of the Edaphodonts, which developed a more or less cutting-and-biting dentition instead of the grinding one. None the less it became extinct owing, apparently, to other specializations which had arisen.

The three species of *Leptomylus* may be distinguished, according to Cope [8, p. 281], by the following key:

I. Mandibular tooth without apical tritor:
  Large, massive, and not compressed. . . . . *L. densus*
II. Mandibular tooth with apical tritor:
  a. Outer margin much elevated; inner much depressed; large. . . *L. forfex*
  b. Outer margin less elevated; inner equally so; smaller. . . . . . . *L. cooki*

Leptomylus densus *Cope.*

1869. *Leptomylus densus* Cope, Proc. Bost. Soc. Nat. Hist., XII, p. 313.

1875. *Leptomylus densus* Cope, Vertebr. Cret. N. Amer., p. 281.

1891. *Leptomylus densus* Cope, Woodward, Catal. Foss. Fishes Brit. Mus., II, p. 86.

1911. *Leptomylus densus* Cope, Fowler, Geol. Surv. New Jersey, Bull. 4, p. 138.

Type.— A mandibular tooth. A palatal tooth was found at the same locality but Cope was not certain that it belonged with the type mandibular.

Horizon and *locality.*— Cretaceous marl pit (probably Hornerstown "K"); Birmingham, New Jersey.

The writer has not seen the type specimen, which has never been figured. Cope's description of it is as follows:

"Anterior extremity [of mandibular] prolonged, and slightly narrowed. The posterior face is plane, transversely concave longitudinally. When the external margin rises, the internal falls off, and the narrow area of dentine is directed obliquely upwards and inwards. The inner face, above an anterior thickened margin as deep as the prolonged beak, is concave, but is again convex near the superior margin. It is marked with coarse and obscure curved lines, which are parallel to the posterior outer margin. The inferior or anterior margin is a contracted ridge, its inner plane vertical, while the superior part of the inner face expands inwards. The dentinal column supporting the tubercle is as large as a goose quill. There are no other columns."

Leptomylus cooki *Cope.*

1870. *Leptomylus cookii* Cope, Proc. Amer. Philos. Soc., XI, p. 384.

1875. *Leptomylus cookii* Cope, Verteb. Cret. N. Amer., p. 382.

1899. *Leptomylus cookii* Cope, Woodward, Catal. Foss. Fishes Brit. Mus., II, p. 87.

1908. *Leptomylus cooki* Cope, Hussakof, Bull. Amer. Mus. Nat. Hist., XXV, p. 41.

1911. *Leptomylus cookii* Cope, Fowler, Geol. Surv. New Jersey, Bull. 4, p. 137, fig. 85.

Type.— An imperfect right mandibular (Fig. 14). Cope Collection, No. 7195 American Museum.

Horizon and *locality.*— "Greensand No. 5" (now Hornerstown "K"; probably equivalent to the Danian of Europe). Near Mt. Holly, New Jersey.

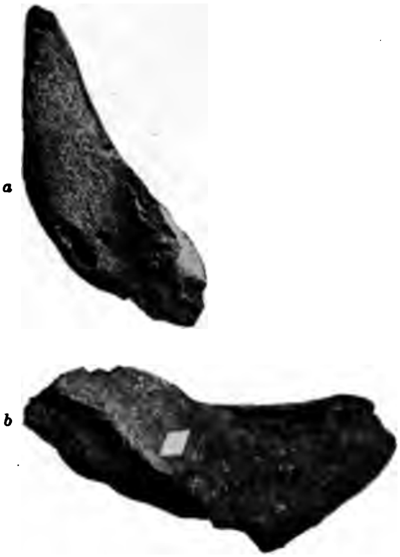

Fig. 14. *Leptomylus cooki* Cope. Right mandibular in oral (*a*), and outer (*b*), views. Type. No. 7195 Amer. Mus. × ½.

Cope's description of this species is as follows:

"In general form the ramus resembles that of *Ischyodus* [*Edaphodon*] *divaricatus*, the posterior portion being curved outwards from the symphyseal. The latter region is much compressed and moderately prolonged, the inner face quite concave; posteriorly the outer face is also slightly concave. There is a single external crest, which is obtuse, and descends gradually to the plane of the beak, and presents no dentinal area. A single small oval area represents the internal, so large in *Ischyodus*. It lies along the inner margin. This margin is much thickened, and rolled over inwards; symphyseal face very narrow. The extremity of the beak is broken away, and the section shows that there is no inferior plate-like column, which produces the terminal area in most species of *Ischyodus*, but a round column, which issues on the upper surface of the beak, behind the apex.

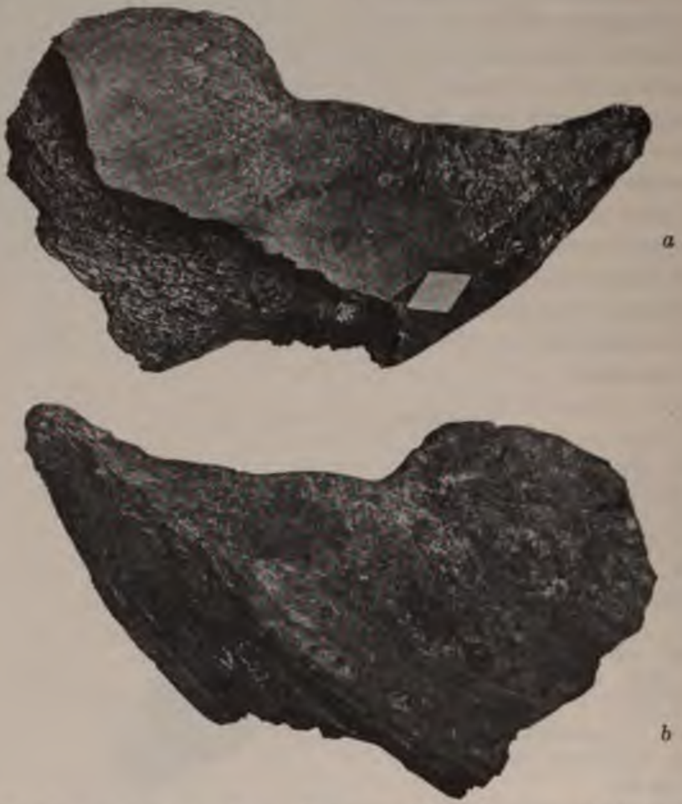

Fig. 15. *Leptomylus forfex* Cope. Right mandibular in outer (*a*), and oral (*b*), views. Cotype. No. 2233 Amer. Mus. × ¾.

"The apical dentinal column of this species, distinguishes it from the *L. densus*, Cope, where no such column exists. It may be noted that at the posterior fractured section of the jaw, the apical column is seen, while [the] internal dental area is not, the latter occupying only a pocket, not a column."

Leptomylus forfex *Cope.*

1875. *Leptomylus forfex* Cope, Cret. Verteb. N. Amer., p. 281.

1891. *Leptomylus forfex* Cope, Woodward, Catal. Foss. Fishes Brit. Mus., II, p. 87.

1908. *Leptomylus forfex* Cope, Hussakof, Bull. Amer. Mus. Nat. Hist., XXV, p. 41, pl. iii, figs. 1, 2.

1911. *Leptomylus forfex* Cope, Fowler, Geol. Surv. New Jersey, Bull. 4, p. 139, fig. 86.

Cotypes.— (1) A right mandibular (Fig. 15); (2) a mandibular and palatine (Fig. 16) of another fish; Cope Collection, Nos. 2233 and 7207 American Museum.

Horizon and *locality.*— "Greensand No. 5" (now Hornerstown marl, "K," which is equivalent to the Danian of Europe). (1) is from Hornerstown, New Jersey, and (2) from near Barnesborough, N. J.

This is a well-marked species characterized by Cope as follows:

"This chimæroid is represented by two mandibles from distant localities, and probably by a maxillary [palatine] bone. The form of these elements is highly characteristic. The mandible is much elevated; but the elevation is confined to the outer side, which rises as a lamina, causing the masticating face to be nearly vertical for much of its length; but a short extent is level to the apex. There is a slight marginal swelling where the anterior outer dentinal area should be, and an abrupt rise in the margin to the position occupied in *Ischyodus* by the posterior outer area. The inner border of the masticating surface is parallel to the inferior border of the jaw, except where the two converge to the apex; here the entire face included between them is occupied by the large symphyseal facet. The inner dentinal area is represented by a narrow acuminate patch on the inner angle of the masticatory face, opposite the tuberosity which represents the anterior outer.

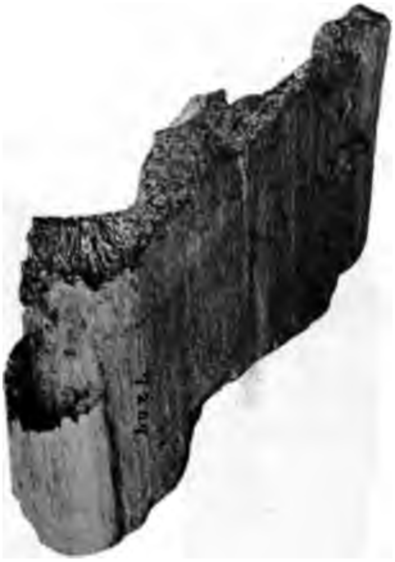

Fig. 16. *Leptomylus forfex* Cope. Left palatal viewed from above. Cotype. No. 7207 Amer. Mus. × 1.

The apical area is very narrow, and extends for some distance along the exterior angle of the superior face."

Genus **Isotænia** *Cope.*

Isotænia Cope, Verteb. Cretac. Formations West, 1875, p. 293.

The genus *Isotænia* is known only from a unique dental plate — a palatal — described and named by Cope in 1875. It represents, apparently, a good genus although little is yet known concerning it. This palatal differs from that of *Edaphodon,* (1) in the absence of a furrow on the upper surface; (2) in having only two tritors; these extend the entire length of the oral face and are separated from each other in the median line of the element by a thin lamina of bone. Type species, *Isotænia neocæsariensis* Cope.

Isotænia neocæsariensis *Cope.*

1875. *Isotænia neocæsariensis* Cope, Vert. Cret. Forma. West, p. 293.

1908. *Isotænia neocæsariensis* Cope, Hussakof, Bull. Amer. Mus. Nat. Hist., XXV, p. 41, pl. iii, figs. 3, 4.

1911. *Isotænia neocæsariensis* Cope, Fowler, Geol. Surv. N. J., Bull. 4, p. 135.

Type.— A left palatal (Fig. 17). Cope Collection, No. 7208 American Museum.

Horizon and *locality.*— Cretaceous "Greensand No. 5" [Hornerstown marl, "K"; equivalent to Danian of Europe]. Hornerstown, New Jersey.

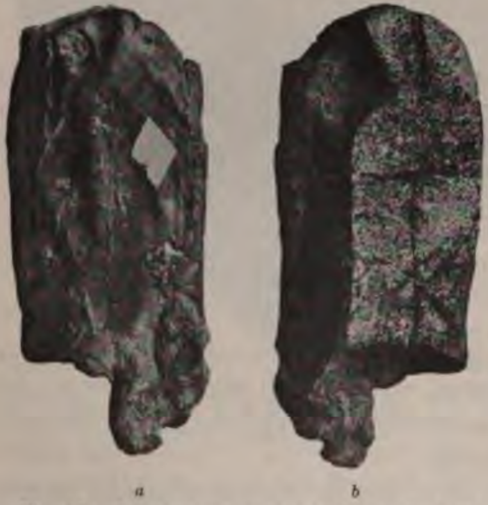

Fig. 17. *Isotænia neocæsariensis* Cope. Left palatal viewed from above (*a*), and in oral aspect (*b*). Type. No. 7208 Amer. Mus. × ⅔.

The principal characters of the species are given above under the generic description. Other trivial features are well brought out in the figures (Figs. 17, 18). Comparative cross-sections of the *Edaphodon* and *Isotænia* palatals are shown in Fig. 18. To facilitate reference to the original description, Cope's account may here be quoted:

"The solid planes of the maxillary bone of this species are three; the widest is opposite to the dentinal columns and parallel with them; it is nearly as wide as they. The lateral planes are not parallel with each other: the wider forms an acute angle with the last described; the narrower, a very obtuse angle, so as to be nearly continuous with the same, running out into it posteriorly. The more vertical side retains the same depth throughout. One end of the bone is rounded and truncate; the other is excavated directly at right angles to the dentinal areæ, and then continued as an edentulous plate, which is soon broken off in the specimen."

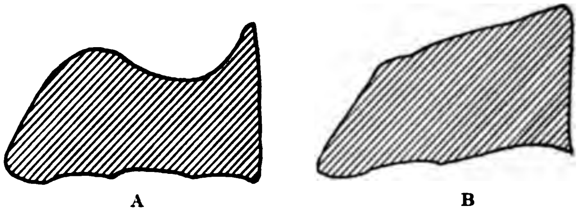

Fig. 18. Cross-sections of *Edaphodon* (A), and of *Isotænia* (B), palatals. Natural size.

Measurements.

Total length	90 mm.
Length of the dentinal columns	66 "
Width of the dentinal columns	30 "
Depth on the vertical side	20 "

Other Chimæroid Remains from the American Cretaceous.

1. The So-called Genus *Bryactinus* Cope. (Figs. 19, 20.)

The fragmentary dental plate on which Cope based the genus *Bryactinus* (Verteb. Cretac. Formations West, p. 282, pl. xlv, figs. 13–13b), is preserved in the American Museum collections (No. 7197). It was refigured by the writer in 1908 [16, p. 37, fig. 13], when its true nature was still not under-

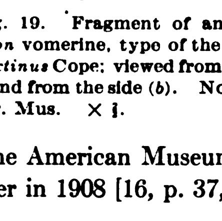

Fig. 19. Fragment of an *Edaphodon* vomerine, type of the genus *Bryactinus* Cope; viewed from above (*a*), and from the side (*b*). No. 7197 Amer. Mus. × ½.

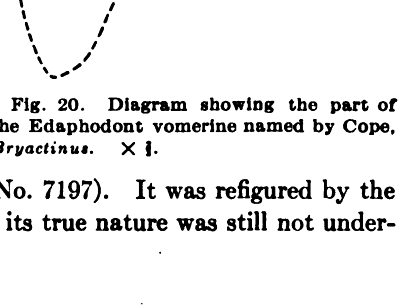

Fig. 20. Diagram showing the part of the Edaphodont vomerine named by Cope, *Bryactinus*. × ½.

stood. It is clearly part of a chimæroid dental plate, but one so fragmentary that it should not have been made a type, certainly not the type of a genus. While restudying the element recently, its true nature became apparent. It is a fragment representing the postero-lateral angle of a left vomerine of *Edaphodon*, as indicated in Fig. 20. Three of the six to nine tritors present in a complete vomerine, are preserved.

As a result of this interpretation, *Bryactinus* is to be considered a synonym of *Edaphodon* and not a distinct genus.

2. The Upper Cretaceous Chimæroid Egg-case.

A fossil egg-case has been described from the Upper Cretaceous of Wyoming, which should here be briefly referred to. A preliminary notice of it was published by Gill [13], and an analysis of its principal characters, accompanied by an excellent photograph, by Dean [10]. The genus to which the capsule belongs cannot, of course, be definitely determined. All one may conclude is, in the words of Professor Dean, that "it presents features which recall the capsules of what have generally been regarded as the older forms [among recent genera] of chimæroids,— callorhynchids, harriottids and rhinochimæroids." [10, p. 265]. Professor Dean considers that "*Elasmodus* (possibly the closely related *Elasmodectes*) might well have been the parental form" of this egg-case.

The main value of this capsule, from the standpoint of the present study, is the evidence it affords of the existence of chimæroids in the Cretaceous sea of the western portions of North America — the so-called Coloradoan sea [Schuchert, 24]; possibly, too, it may indicate the existence, in American waters, toward the close of the Cretaceous, of another genus in addition to those described in the preceding pages.

3. The Supposed Chimæroid Fin-spine, *Sphagepœa aciculata* Cope.
(Fig. 21.)

In 1869, Cope [6, p. 241] described a very small, incomplete spine, which he thought might represent a pycnodont, a chimæroid, or even a plectognath, which he named *Sphagepœa aciculata*. The type is preserved in his collection in the American Museum (No. 2235), and was figured by the present writer, in his 'Catalogue of Types and Figured Specimens,' in 1908 [16, p. 50, fig. 22]. The only reason for referring to this spine here is the opinion expressed by Cope that it might belong to a chimæroid, and the statement by Woodward [27, p. 84] that it might "possibly" belong to *Edaphodon*.

The spine is well represented in Fig. 21. It is very small, probably not over 1½ or 2 centimeters in length when complete, and armed on the anterior margin with small, sharp, upwardly-pointing denticles. The lateral faces bear several striations which extend the entire preserved portion of the spine; and posteriorly it presents two ridges separated by a deep groove.

To the writer it has seemed doubtful whether *Sphagepœa* represents a chimæroid, and in the 'Catalogue' mentioned above, he placed the genus among the Ichthyodorulites. This view has been adopted by Fowler [11, p. 144]. In all chimæroids, from *Myriacanthus* up, the dorsal fin-spines are singularly constant in general character. The anterior margin is a sharp edge without denticles; whereas the posterior face is armed with two rows of small denticles, separated from each other by a furrow extending nearly the whole length of the spine. (*Cf.* figure of *Edaphodon* spine, Fig. 5). Now in the small spine, *Sphagepœa,* both these characters are lacking: the anterior margin, instead of being smooth, has a row of denticles, and the posterior face lacks the double row of denticles always present in chimæroid spines. It seems best, therefore, not to express any positive opinion regarding the affinities of *Sphagepœa,* but to place it, for the present at least, among the Ichthyodorulites.

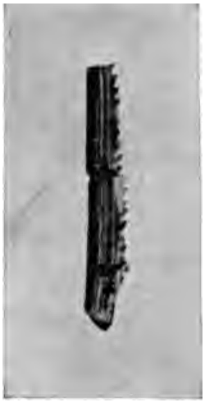

Fig. 21. *Sphagepœa aciculata* Cope. Incomplete fin-spine. Type. No. 2235 Amer. Mus. × 4.

Summary of General Conclusions.

It is shown in this paper that:

1. The genera of Cretaceous chimæroids which have been described from North America are reducible to three — *Edaphodon, Leptomylus, Isotænia.*
2. *Edaphodon* is the most common form. The 12 species which have been referred to it are reducible to six.
3. Of these six, the two named by Cope, *Edaphodon smocki* and *E. tripartitus,* are identifiable with the European forms *E. agassizi* and *E. sedgwicki,* respectively.
4. These two species survived to a later time (Danian) in America than in Europe (Senonian). The time relations between Europe and America at the close of the Cretaceous were similar to those of the present day; *i. e.,* certain species still living in America which had but recently (in a geological sense) become extinct in Europe.

5. *Leptomylus* represents the advancing line with a tendency to develop cutting, instead of crushing, dental plates. This genus, however, is too specialized to be considered ancestral to the modern forms. Their ancestor is probably a genus like *Elasmodus* or *Elasmodectes*.

6. There are three localities in America from which Cretaceous chimæroids are at present known: New Jersey, Mississippi and Wyoming. The first has yielded 9 of the 11 American forms, the other two localities only one species each.

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EXPLANATION OF PLATES.

PLATE XIX.

Edaphodon mirificus Leidy. × $\frac{1}{3}$.

Figs. 1, 2. Type of "Diphrissa solidulus" (Cope). Left mandibular in outer (1), and oral (2), views. No. 7193 Amer. Mus.

Fig. 3. Type of *Edaphodon* "gaskilli" (Cope). Left mandibular in oral aspect. No. 7196 Amer. Mus.

Figs. 4, 5. Two of the types of *Edaphodon* "fecundus" (Cope). Left mandibular in outer (4), and oral (5), views. No. 2225 Amer. Mus.

Figs. 6, 7. Type of *Edaphodon* "longirostris" (Cope). Left mandibular in outer (6), and oral (7), views. The tip of the mandibular is restored. No. 2230 Amer. Mus.

Figs. 8, 9. Type of *Edaphodon* "incrassatus" (Cope). Right mandibular in outer (8), and oral (9), views. No. 2234 Amer. Mus.

All from the Jerseyan, probably Hornerstown "K" division [= Danian of Europe]; mostly Hornerstown, N. J.

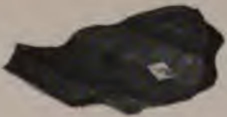
PLATE XX.

Fig. 1. Large chimæroid dorsal fin-spine, type of Marsh's genus *Dipristis* (*D. meirsii*); probably identical with *Edaphodon mirificus* Leidy. *den.*, posterior denticles.

Upper Cretaceous (Hornerstown, "K"); Hornerstown, New Jersey. No. 292 Yale University Museum. × $\frac{1}{4}$.

Figs. 2, 3. *Edaphodon mirificus* Leidy. Palatal plate in oral (2), and lateral (3), views. Cotype of *Edaphodon* "fecundus" (Cope). No. 2225 Amer. Mus. × $\frac{2}{3}$.

Jerseyan, probably Hornerstown "K" division [= Danian of Europe]; Hornerstown, New Jersey.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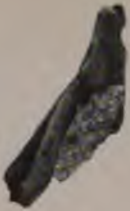
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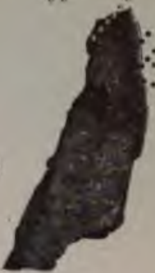
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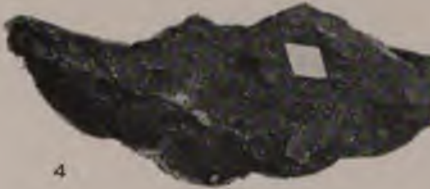
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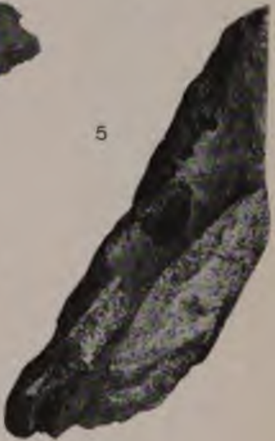
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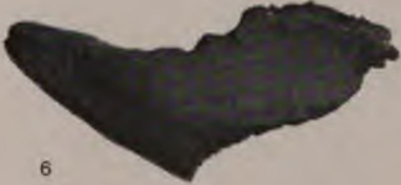
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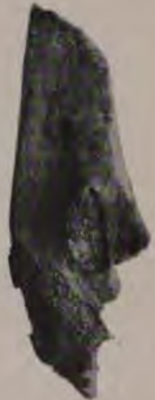
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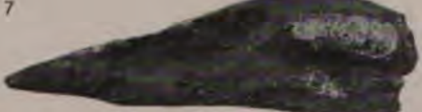
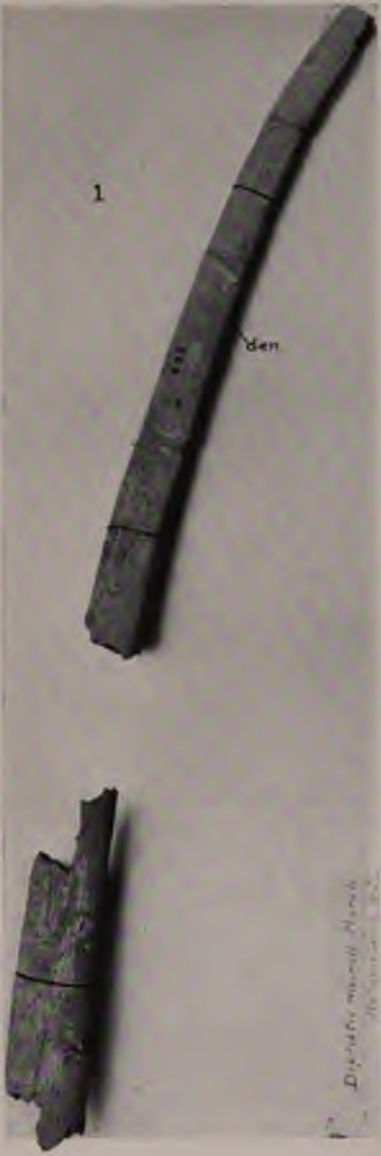
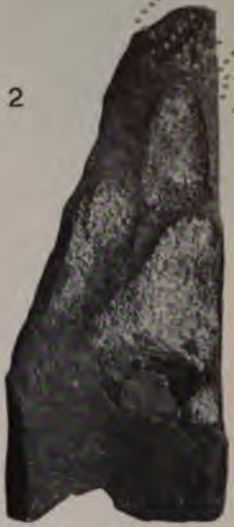
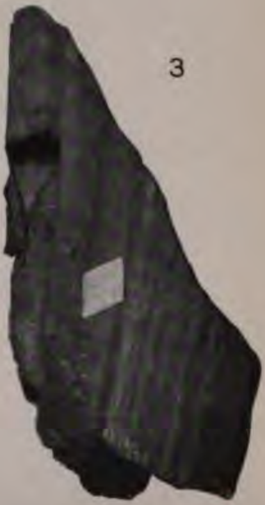


CHIMÆROID DENTAL PLATES (*Edaphodon*).







CHIMÆROID FIN-SPINE AND PALATAL PLATE (*Edaphodon*).

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Article XX.— MOLLUSCA FROM THE TERTIARY STRATA OF THE WEST.

BY T. D. A. COCKERELL AND JUNIUS HENDERSON.

PLATES XXI AND XXII.

The American Museum of Natural History has in the course of a number of years brought together a small but important collection of land and freshwater mollusca from the mammal-bearing horizons of the western States. These materials have been secured incidentally while searching for vertebrate remains, and it is probable that they do not adequately represent the Molluscan faunæ of the several localities, the smaller species especially having been frequently overlooked. Nevertheless, considering the very scanty knowledge we possess of the Tertiary land and freshwater mollusca of North America, and the fine species now added to the short list, the collection must be considered a very valuable one; especially since the species come from horizons the precise relative age of which is known. We are greatly indebted to Dr. W. D. Matthew for the opportunity to study and describe the collection.

LAND MOLLUSCA.

BASAL EOCENE.

Helix nacimientensis *White.*

Plate XXI, Figs. 3, 4.

Helix nacimientensis WHITE, Bull. 34, U. S. Geol. Surv. (1886), p. 26; pl. 5, figs. 3–5.

Lysinoë nacimientensis (White) COCKERELL, Bull. Amer. Mus. N. Hist., XXVII (1906), p. 459.

Numerous young, and three adults, collected in the Torrejon beds, Rio Torrejon, seventy miles west of Nacimiento, New Mexico (*Brown*, 1896). This species was described from the Puerco, at a time when the Torrejon had not been given a separate name. Probably all the Puerco mollusca recorded by White in the Bulletin cited come from the Torrejon.

Young specimens show the sculpture of the upper whorls, consisting of rather coarse oblique lines of growth. In some shells there is an appearance of spiral grooving, but this is certainly due to weathering. Very young shells, less than 8 mm. diameter, have a sharp keel. Adults vary considerably in form, some being higher and more compact than others; it is possible that the flatter and broader ones represent a second species, but we believe not. Pilsbry (Manual of Conchology, part 58, p. 68) remarks that this species is "apparently referable to the Mexican genus *Lysinoë*, judging by the size, the circumumbilical angle, etc." There is a superficial resemblance to *Helix spatiosa* Meek & Hayden, from the Lower Eocene, but the latter has rounded whorls and a wider umbilicus.

With the *H. nacimientensis* is a single specimen of another species, crushed and very imperfect. It seems too large for *H. adipis* White, and so far as can be seen does not differ from *H. riparia* White, described from the Green River Eocene. It probably represents an undescribed species, which if complete would be found to differ from *H. riparia*.

LOWER EOCENE.

Oreohelix megarche sp. nov.

Plate XXII, Figs. 4–6.

Shell depressed, the spire broadly subconical; whorls about 5½, flattened above and below, the last whorl with the periphery obtuse, broadly rounded, but the earlier ones angular, a strong keel extending as far as the fourth; sutures rather prominent; umbilicus widely open, with a diameter of about 10 mm.; aperture apparently as usual in *Oreohelix*, but not perfectly preserved in any of the specimens. Embryo (about two whorls) with strong, regular, close oblique ribs, following the lines of growth, about eight in one mm.; rest of shell rather coarsely obliquely strigose, the sculpture more or less irregular, the ribs increasing in size on the later whorls, where they are moderately sharp, about ten in five mm., but not distinct or even enough to count accurately. Diameter, max. 41, min. 35 mm.; alt. about 23 mm.; spire 10 mm. or considerably less.

Locality.— Wasatch beds, Big Horn Basin, Wyoming, five specimens. The type and three others were collected three miles southeast of Otto (*W. S.*, Aug. 14, 1910).

This very fine species is larger than any living *Oreohelix*, but in spite of its great antiquity, we feel confident in referring it to that genus. The sculpture and form agree exactly, and in particular the very characteristic sculpture of the embryonic whorls reproduces accurately the condition found in such species as *O. chiricahuana* Pilsbry from Arizona. The spiral sulcus or depression above the suture, characteristic of the upper whorls of *Oreohelix*, is distinctly visible.

Oreohelix grangeri sp. nov.

Plate XXI, Figs. 5–9.

Shell depressed, the specimens crushed, but apparently originally at least as flat as *O. elrodi* Pilsbry; whorls about 4⅛ (probably not quite adult); periphery very sharply keeled; surface coarsely obliquely irregularly strigose; embryo shell with regular fine sharp ribs as in other species, about 12 in a mm.; no distinct spiral lines, above or below. Max. diam. about 21 mm.

Locality.— Ralston Beds; Lower Eocene of Big Horn Basin, Wyoming (*Sinclair and Granger*). Three specimens.

This is very like *O. elrodi* Pilsbry, but the nuclear whorls are more convex, with finer sculpture, and without the depressed line above the suture. With regard to the general sculpture of the shell, the fossil may be compared more closely with *O. chiricahuana percarinata* P. & F., which only seems to differ in the more evident traces of spiral lines.

Gastrodonta (?) **evanstonensis** (*White*).

Helix evanstonensis WHITE, Bull. U. S. Geol. & Geog. Surv. Terr., IV, 1878, p. 714.

Described from the Evanston beds, supposed at the time to be Laramie Cretaceous, but now considered to be Eocene.

Gastrodonta (?) **evanstonensis** var. **sinclairi** v. nov. *Cockerell.*

Plate XXI, Figs. 1, 2.

Alt. nearly 9 mm., diam. 9 mm. Differs from the typical form by the more elevated spire. Whorls six; base flattened; last whorl obliquely striate. Apparently a *Gastrodonta* of the type of *G. ligera* (Say). It is very likely a distinct species, but the resemblance to *H. evanstonensis* is such that it seems better at present to regard it as a variety.

Hab.— "About three miles north of Ralston; ? Wasatch (Ralston Beds); Big Horn Basin, Wyoming." Collected by W. J. Sinclair, Aug. 12, 1911.

It was found with a couple of *Physa pleromatis* White and a quantity of *Vivipara paludinæformis* Hall.

Glyptostoma (?) **spatiosum** (*Meek & Hayden*).

Helix spatiosa MEEK & HAYDEN, Proc. Acad. Nat. Sci., Phila. for 1861, p. 446.

Macrocyclis spatiosa (M. & H.) MEEK, Rept. U. S. Geol. Surv. Terr., IX (1876), p. 594.

The collection contains very good specimens from the Wind River Beds, five miles west of Buck Spring, Alkali Creek, Wyoming, collected by Walter

Granger, Aug. 23, 1909. The shell has the closest possible resemblance to the living (Californian) *Glyptostoma newberryanum* (W. G. Binney), which was formerly referred to *Macrocyclis*, the genus *Glyptostoma* not having been separated when Meek wrote. Our largest specimen of *spatiosum* has a diameter of 47 mm. which happens to be exactly the diameter of Binney's largest *G. newberryanum*. The modern shell is considerably more depressed than *G. spatiosum.*

OLIGOCENE.

Helix leidyi *Hall & Meek.*

Plate XXII, Figs. 1-3.

Helix leidyi HALL & MEEK, Rept. U. S. Geol. Surv. Terr., IX (1876), p. 604.

This is a species having much the form of the Mexican *Helix buffoniana* Pfeiffer. The shells vary from alt. 28, diam. 29 mm., to alt. 23, diam. 30 mm., but this appears to be a matter of individual variation. The more depressed form occurs along with the subglobose form in the Protoceras beds.

The localities represented are (1) Protoceras Beds, Cheyenne R., S. Dakota, and (2) Oreodon Beds, White River, one mile north of Grover, S. Dakota, 1902. In the original description, this species was ascribed to the Miocene.

Omphalina oreodontis sp. nov.

Plate XXI, Figs. 10, 11.

Shell depressed, with about 3½ whorls, the last near the mouth as broad as the whole spire; upper surface not well preserved, but showing feeble oblique striæ following the lines of growth; under surface of last whorl smooth and shining, porcelain-like, without evident sculpture; columella apparently rather robust; umbilicus reduced to a chink, or at least small and narrow; aperture nearly 12 mm. high, 13 broad; periphery rounded. Max. diam. 24, alt. 13 mm.

Locality.— Oreodon Beds, Pawnee Buttes, Colorado.

Except that it is more depressed, this seems to correspond very closely with *O. lævigata* (Pfeiffer) of the Southern States.

Polygyra dallii *Stearns.*

Helix (*Monodon* ?) *dallii* STEARNS, Bull. 18, U. S. Geol. Survey (1885), p. 14.
Polygyra dalli STEARNS, Proc. Wash. Acad. Sci., II (1900), p. 655.

John Day Formation, John Day Basin, Oregon, collected by Wortman, Sternberg and others, about 1879.

This should not be cited as of "Stearns ms., White," as the whole of the description is by Stearns, and is properly credited to him.

FRESHWATER GASTROPODA.

EOCENE.

Planorbis militaris *White.*

One, in the same material as the types of *Oreohelix grangeri.* Ralston Beds (Lower Eocene), Big Horn Basin, Wyoming.

Planorbis utahensis *Meek.*

In spite of its name, this species was originally described from Wyoming. The present excellent material has two labels, the field label stating that it is from Washakie B, upper beds, below white stratum, Haystack M., east Wyo.; collector P. M., Oct. 2, 1906.

The other, later, label says Washakie horizon ? A.

Physa pleromatis *White.*

Two collected with *Gastrodonta* (?) *sinclairi,* Big Horn Basin, about three miles north of Ralston (*W. J. Sinclair*).

Vivipara paludinæformis *Hall.*

Many collected with *Physa pleromatis,* as given above.

Vivipara wyomingensis *Meek.*

One fine shell; Upper Bridger, Bridger Basin, Wyoming (*W. G.,* 1904).

Goniobasis tenera *Hall.*

Good material from the Wasatch, one mile south of St. Joe, Wyoming (*Granger,* 1910). There is some other material in the collection which cannot now be determined definitely.

(1.) Tatman Mt., Big Horn Basin, Wyoming, about 200 ft. below top; possibly White River formation. Ganoid fish scales and very imperfect shells, including a *Vivipara* of the type of *wyomingensis* Meek and a *Planorbis* resembling *florissantensis* Ckll. See also Bull. Am. Mus. N. Hist., XXX, p. 110.

(2.) Laramie Cretaceous, S. Dakota; "locality unknown; with White River collections." A *Vivipara* in very poor condition; it may be *V. lea* M. & H., so far as anything shows.

EXPLANATION OF PLATES.

PLATE XXI.

Fig. 1. *Gastrodonta evanstonensis sinclairi* Ckll. Big Basin, Wyo. Type $\frac{4}{1}$.
“ 2. “ “ “ “ “ “ “ “ $\frac{3}{1}$.
“ 3. *Helix nacimientensis* White. 70 miles W. of Nacimiente $\frac{1}{1}$.
“ 4. “ “ Depressed form. 70 miles W. of Nacimiente $\frac{1}{1}$.
“ 5. *Oreohelix grangeri* C. & H. Big Horn Basin, Wyo. $\frac{2}{1}$.
“ 6. “ “ “ “ “ “ “ $\frac{2}{1}$.
“ 7. “ “ “ “ “ “ “ $\frac{2}{1}$.
“ 8. “ “ “ “ “ “ “ $\frac{2}{1}$.
“ 9. “ “ Spire enlarged. Big Horn Basin, Wyo. $\frac{8}{1}$.
“ 10. *Omphalina oreodontis* C. & H. Pawnee Buttes, Col. Type $\frac{2}{1}$.
“ 11. “ “ “ “ “ “ “ $\frac{2}{1}$.

PLATE XXII.

Fig. 1. *Helix leidyi* Hall & Meek. Young. $\frac{2}{1}$.
“ 2. “ “ $\frac{2}{1}$.
“ 3. “ “ $\frac{2}{1}$.
“ 4. *Oreohelix megarche* C. & H. Big Horn Basin, Wyo. $\frac{1}{1}$.
“ 5. “ “ $\frac{1}{1}$.
“ 6. “ “ Spire enlarged. $\frac{8}{1}$.

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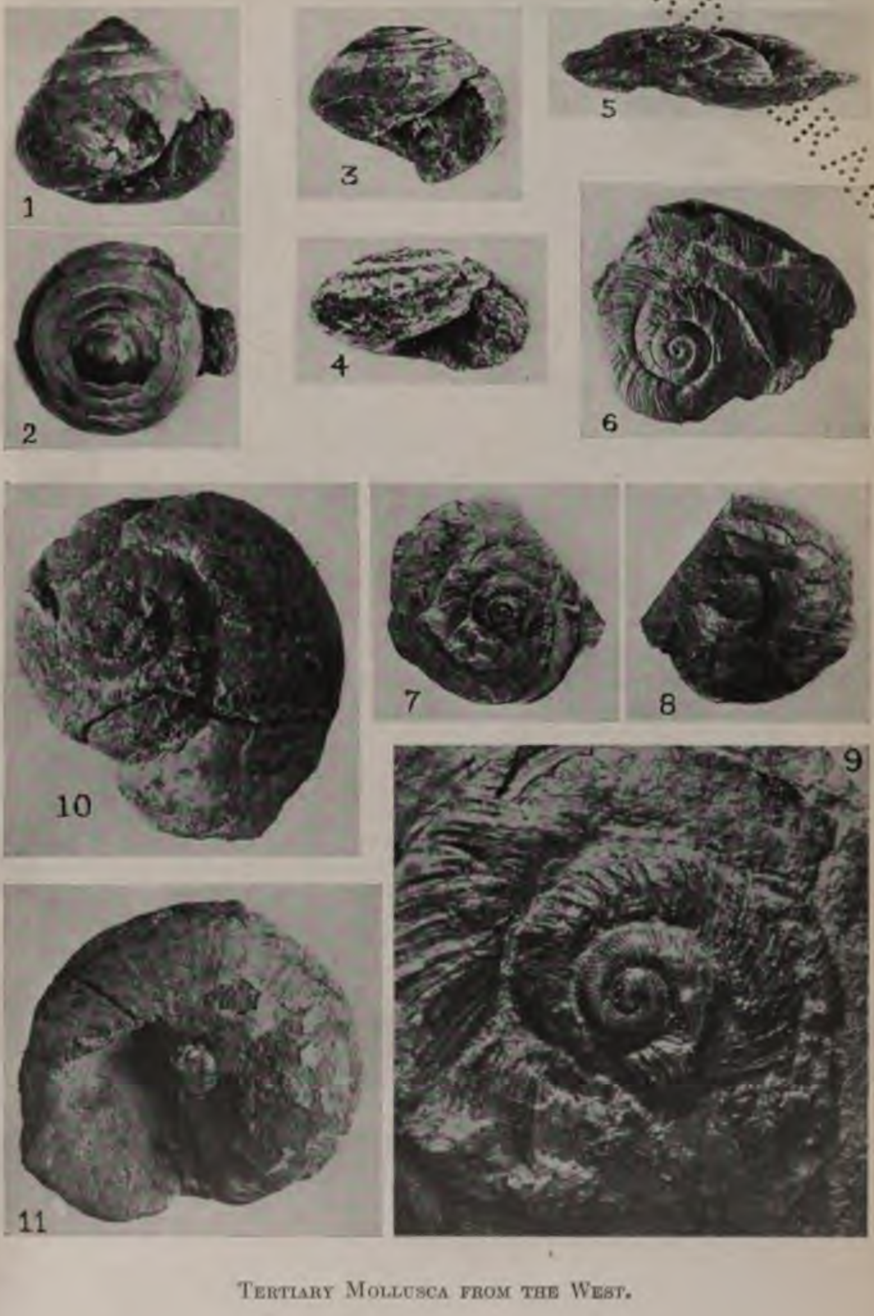

Tertiary Mollusca from the West.

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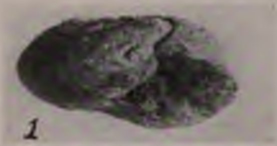
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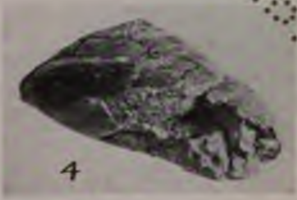
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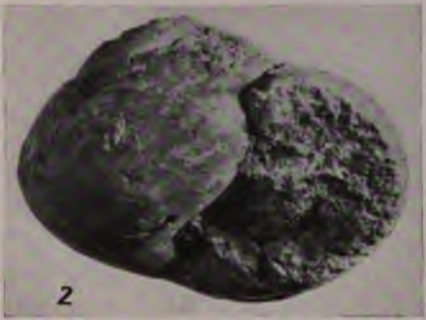
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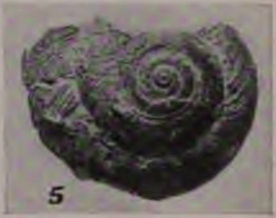
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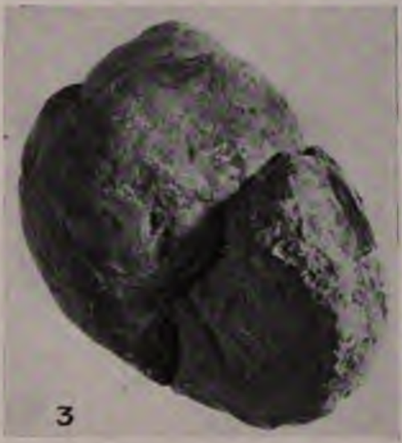
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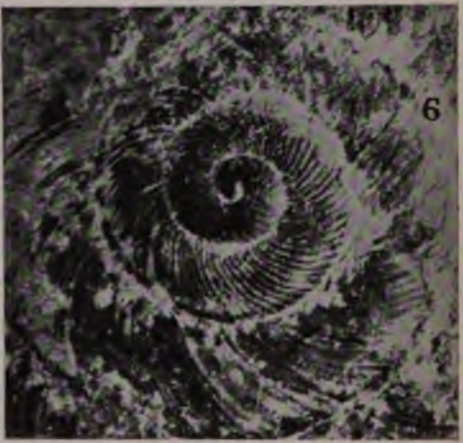
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Tertiary Mollusca from the West.

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Article XXI.— A NEW IBIS FROM MT. KENIA, BRITISH EAST AFRICA.

BY FRANK M. CHAPMAN.

PLATES XXIII AND XXIV.

Mr. and Mrs. Carl E. Akeley have recently presented to the American Museum a pair of Ibises, together with their nest, a portion of an egg-shell, and three young, which they collected on the south slope of Mt. Kenia, British East Africa, at an altitude of 9000 feet. They also observed the same species on the higher parts of Mt. Elgon and of the Aberdare Mountains. It appears to represent an undescribed generic type for which, with relation to its range and in honor of its discoverers, I propose the name

Oreoibis akleyorum gen. et sp. nov.

Char. gen.— Most nearly related to *Hagedashia*, but pileum with a conspicuous crest of rounded feathers, 90 to 100 mm. in length; entire orbital and loral space bare and not papillose, resembling, in this respect, *Lophotibis* (which, however, has the tarsus scutellate not reticulate as in the present genus). Related also to *Lampribis* but with the forehead and the base of the mandible feathered, the bill shorter and heavier, the crest more pronounced. Type, *Oreoibis akleyorum.*

Char. sp.— Agreeing in size with *Hagedashia hagedash*, in color most closely resembling *Lampribis olivacea*, but crest wood-brown, malar stripe buffy, greater wing-coverts externally bronzy as in *Hagedashia*, back greener.

Type.— No. 111218, Am. Mus. Nat. Hist., ♂ ad., alt. 9000 ft., south slope of Mt. Kenia, British East Africa, Sept. 5, 1910; Mr. and Mrs. Carl E. Akeley.

Description of Type.— Head and neck all around rich wood-brown, the anterior portion of the crest slightly darker medianly, the longer feathers with faint silvery lateral margins; an evident but not sharply defined buffy malar stripe; back and interscapulars olive-green with bronze reflections, the former margined with wood-brown; lower back, rump, and upper tail-coverts dark blue with greenish reflections; wing-quills dark purple, the exposed portions richer, the color increasing in intensity on the inner secondaries which are tinged with greenish on the terminal portions of the outer vanes, while the tertials become bronzy olive-green; primary and greater wing-coverts purple, the outer vanes of the latter, except at the tip, golden bronze producing, in the proper light, a well-defined area of this color; remaining wing-coverts highly metallic vivid green with, in certain lights, strong purplish reflections; this color occupies about the basal half of the closed wing and is sharply defined from the colors of the rest of the wing; breast dark wood-brown with green reflections, rest of underparts olive-green, richer on the flanks, the feathers all more or less margined with brownish; thighs purplish wood-brown; lower tail-coverts much like upper tail-coverts; under wing-coverts and axillars purplish black; bill dark maroon, brownish basally; bare areas on the head dull black; feet brownish horn; in life "bill red, bare portions of head ashy black, legs olive; iris dark brown" (Akeley).

Culmen, 119; mandible from gonys, 48; distance from gonydeal angle to interramal feathers, 49; depth of bill at posterior margin of nostril, 27; width at same place, 17; from posterior margin of nostril to posterior margin of bare orbital space, 48; wing, 368; tail, 168; tarsus, 65.5; middle toe and claw, 75; hind-toe and claw, 36; bare portion of tibia, 30 mm.

Description of female.— Resembles the male in color but is slightly smaller. Culmen, 113; mandible from gonys, 46; distance from gonydeal angle to interramal feathers, 48; depth of bill at posterior margin of nostril, 24.5; width at same place, 16; from posterior margin of nostril to posterior margin of bare orbital space, 48; wing, 336; tail, 162; tarsus, 64.5; middle toe and claw, 69; hind-toe and claw, 32; bare portion of tibia, 26 mm.

Description of young in natal down.— Uniform brownish black; the orbital and loral region bare as in the adult.

Description of egg.— (Based on part of shell figured). Ground-color pale pea-green more or less stained with cinnamon-rufus and with irregular blotches of chestnut more or less evenly distributed. Much less heavily marked, therefore, than the egg of *Hagedashia* as figured in Cat. Eggs B. M., II, pl. i, fig. 5.

Remarks.— Any opinion in regard to the generic status of Ibises depends largely upon the relative classificatory value given to the manner in which the head is feathered. To ignore this character would result in the union of genera whose distinctness has long been recognized, while the consistent application of similar standards leads us to the view of Reichenow[1] who, in a recent article, places *Lampribis* and *Hagedashia* in the genus *Theristicus*. The two former are forest-inhabiting, the latter frequents plains and pastures where its more active habits, both on the ground and in the air, are apparently reflected in its longer legs and tail and markedly more pointed wings, while its color scheme is evidently related to the open nature of its haunts and is as different from that of *Lampribis* and *Hagedashia* as plain is from forest. There is, therefore, abundant reason for the numerous generic differences which exist between the American and African birds, and we imagine that few ornithologists will endorse Reichenow's estimate of their generic relationships. To have referred *Lampribis* to *Harpiprion* would have been more to the point. When, however, it comes to a consideration of the African birds *inter se*, the lines are more tightly drawn.

Having no material with which to discuss the standing of the various races of *Lampribis olivacea*, I may simply state that my single specimen of this species (collected by Du Chaillu on the River Muni in Western

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[1] Ornith. Monatsb., 1903, pp. 132–136.

Africa and loaned me by the Academy of Natural Sciences of Philadelphia) closely agrees with Elliot's plate (P. Z. S., 1877, Pl. LI) but lacks the purplish on the lesser wing-coverts which, as Salvadori[1] has said, was probably added for artistic effect.

The brownish margins of the feathers of the underparts of this specimen, which are accurately shown by Elliot's plate, are said to indicate immaturity, but it is worthy of note that the bare forehead and face are similar to those of the adult, evidence of the genetic value of this character. More striking proof of this belief is furnished by the newly hatched young of *Oreoïbis* which, as the accompanying plate shows, have the bare areas of the head similar in extent to those of the adult. As an alternative, therefore, to placing distantly related Ibises under one genus, I feel that we are here warranted in accepting the pterylosis of the head as of significance in creating generic distinctions.

Hagedashia, Lampribis, and *Oreoïbis* form a group of closely related generic forms which agree in possessing certain characters in common (*e. g.*, rounded wings, short tarsi, and a more or less well defined malar stripe) while other characters (*e. g.*, crested pileum and pattern of wing coloration) are shared by only two of the three, and in the feathering of the head no two are alike. In some respects *Oreoïbis* is intermediate between *Lampribis* and *Hagedashia*, having the crest and general color of the former, and the size, type of bill and pattern of wing-covert coloration of the latter; but in its bare facial areas and feathered chin it is unlike any other Ibis except *Lophotibis*, from which it is widely differentiated by possessing reticulate in place of scutellate tarsi.

It is not often that in publishing a description of a new generic type of bird one may also include a photograph of its nest and young, and a description of its habits. Thanks, however, to Mr. and Mrs. Carl E. Akeley, the discoverers and collectors of this fine new Ibis, I can present the accompanying plate and append the following field-notes written by Mr. Akeley:

"We first observed this Ibis when camped in the bamboo forest at about 8000 feet altitude on the Aberedare Mountains. Night after night, just at dusk, a pair of them would fly over our camp always in the same direction. It was rare that we could get a glimpse of them as they flew high above the forest, but their loud, raucous cries seemed to drown all other forest sounds. At this time we supposed them to be Caffer Ibises (*Hagedashia*), which we had collected on Lakes Naivasha and Elementeita, some 3000 feet lower down in the Rift Valley. The calls seemed to me to be precisely similar to those of that species and we assumed that the birds were coming up into the mountain forests to spend the night.

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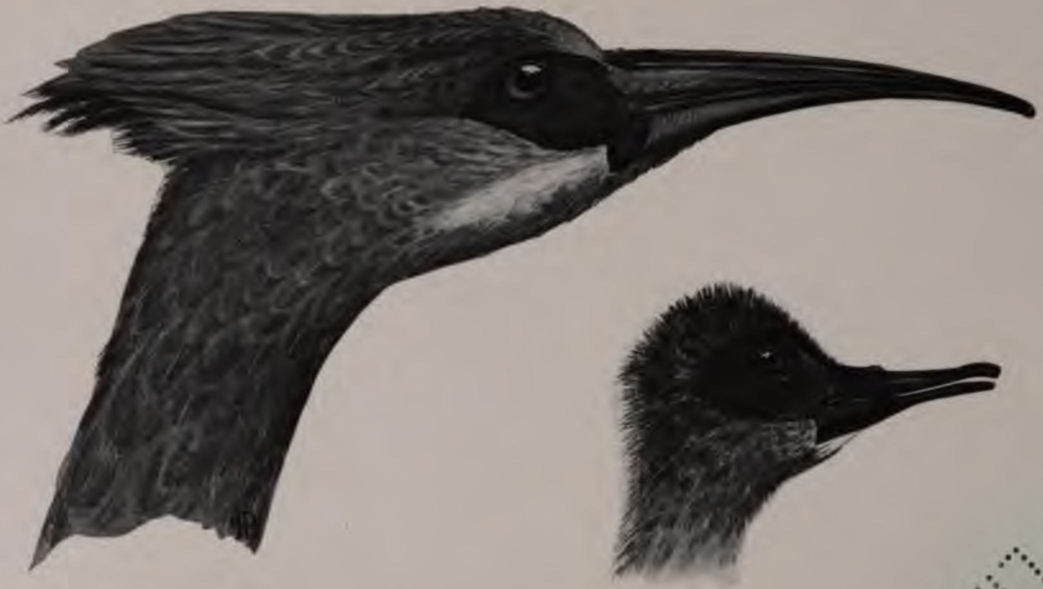
[1] Ibis, 1903, p. 182.

"Later, while hunting in the forests of Mt. Kenia, we flushed a small flock that were feeding on the ground in the dense jungle where the bamboo and forest proper meet. This is at about 10,000 feet. On this occasion, as the birds flew from the ground, they perched for an instant on low branches, throwing out their crests and we realized that they were not *Hagedashia.* Then for many weeks we had no opportunity to observe a specimen, though every evening a number of pairs would fly over high above our camp deadening all other sounds with their extraordinary clamor.

"At last one of them, hard pressed by a hawk, after curving and dodging above our camp until nearly exhausted, took refuge between our tents and it was secured. This was the only specimen collected on that trip.

"In 1910, when camped in dense forest at about 9000 feet on Kenia, Mrs. Akeley observed a nest within a hundred yards of our camp. It was loosely constructed of dead branches on the limb of a small tree about 25 feet from the ground, and contained three young and a fragment of an egg-shell. We secured the birds, old and young, after photographing them and their nest. The stomach of the male contained only a few fragments of beetles while that of female contained a large quantity of vegetable matter — apparently green leaves, beetles, and segments of Myriopods. The abdomen of the female was less denuded of feathers than that of the male.

"This is a mountain-inhabiting Ibis and we observed it only in the Aberdare Mountains at 9000 feet; on Mt. Kenia from 6000 to 12,000 feet (timber line); and on Mt. Elgon from 8000 to about 10,000 feet, while *Hagedashia* was not found to range above 6000 feet."



OREOIBIS AKLEYORUM.

Head of adult, one-half natural size. Head of young, natural size.

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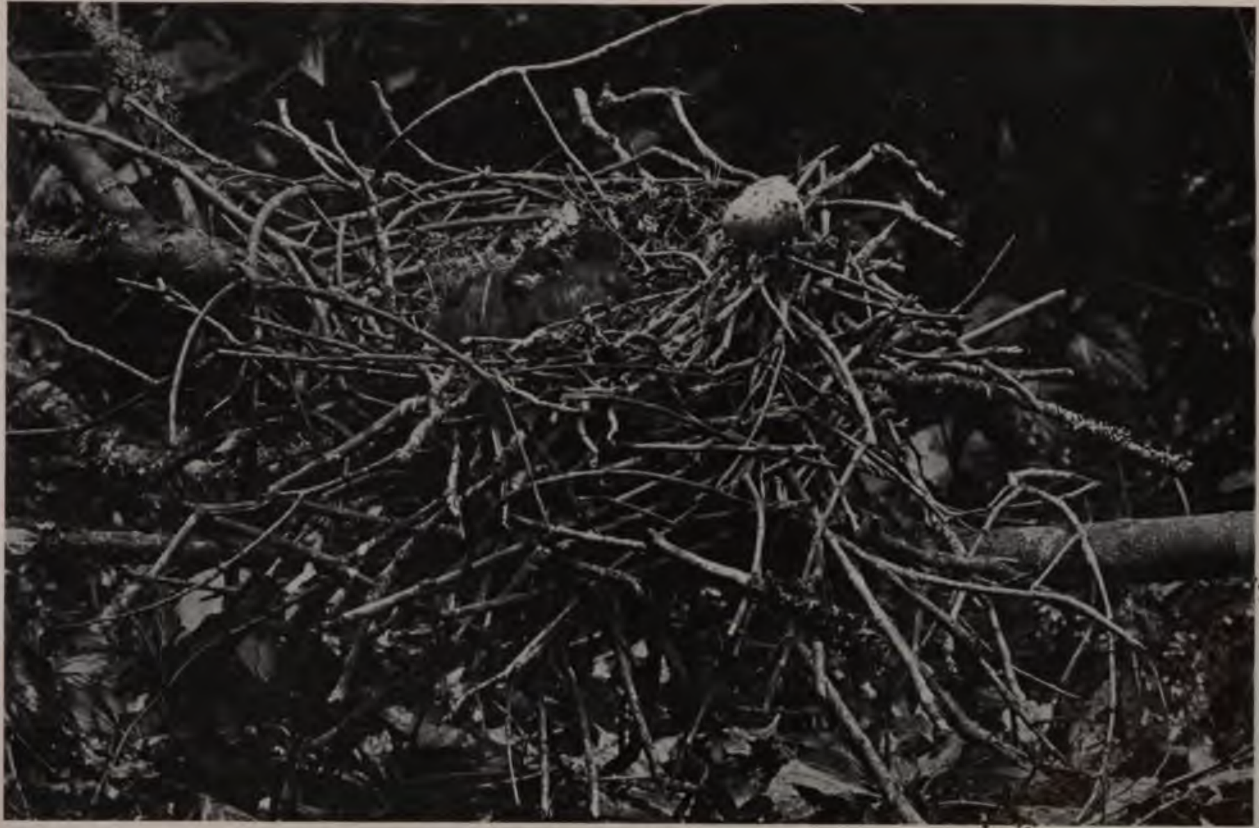

NEST, THREE YOUNG, AND PART OF EGG-SHELL OF *Oreoibis akleyorum*.

Photographed by C. E. Akeley.

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Article XXII.—A REVISION OF THE CLASSIFICATION OF THE KINGFISHERS.

By W. DeW. Miller.

Plates XXV and XXVI.

INTRODUCTION.

The purpose of the present paper is mainly two-fold, first: To establish the proper subfamily divisions of the Alcedinidæ; second, to bring out the characters and relationships of the three genera currently united under *Ceryle*.

The conclusions are based on all available material both in the form of skins and skeletons, and lists of the species examined are appended. The first list includes members of every currently recognized genus of the family.

Dr. P. Chalmers Mitchell's paper 'On the Anatomy of the Kingfishers'[1] has been drawn upon for the myological characters.

The greater part of the material used is in the collection of the American Museum of Natural History. For the loan of additional specimens I am much indebted to the United States National Museum, through Dr. Charles W. Richmond, to the Brooklyn Institute of Arts and Sciences, through Mr. Robert C. Murphy, and to Mr. James H. Fleming of Toronto.

PART I. THE SUBFAMILIES OF ALCEDINIDÆ.

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[1] Ibis, 1901, p. 97.

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- Alcedininæ 250
- Daceloninæ 253

The position of *Ramphalcyon* 259
Remarks on other Genera 261

List of Species Examined.

I. *Skins.*

Ramphalcyon melanorhyncha
- amauroptera
- capensis (races)

Megaceryle (all species, not *M. maxima sharpei*)
Ceryle (all forms)
Chloroceryle (all species)
Alcedo ispida
- bengalensis
- ispidoides
- semitorquata
- meninting
- beryllina

Corythornis vintsioides
- cristata

Alcyone azurea
- cyanopectus

Ceyx euerythra
- innominata
- melanura

Ceycopsis fallax
Ispidina picta
- natalensis

Myioceyx lecontei
Syma torotoro
Lacedo pulchella
Melidora macrorhina
Clytoceyx rex
Dacelo gigas
- leachi

Choucalcyon gaudichaudi
- tyro

Halcyon coromandus
- smyrnensis
- gularis
- pileatus
- semicæruleus
- albiventris
- senegalensis
- malimbicus
- cyanoleucus
- saurophagus
- lazuli
- diops
- macleayi
- pyrrhopygius
- cinnamominus
- sacer
- chloris
- tristrami
- sanctus
- funebris
- concretus
- lindsayi

Todiramphus recurvirostris
Cittura cyanotis
Monachalcyon monachus
Tanysiptera nympha
- sylvia
- doris
- margaritæ
- galatea
- dea

II. *Skeletons.*

Ramphalcyon capensis (palatines imperfect)
Megaceryle torquata
- alcyon

Chloroceryle americana
- amazona (skull, palatines imperfect)

Alcedo ispida (skulls)
Dacelo gigas
Halcyon chloris (palatines imperfect)
- " concretus (sternum and shoulder girdle)

SUMMARY OF CONCLUSIONS.

The family Alcedinidæ is divisible into three subfamilies, Cerylinæ (3 genera), Alcedininæ (7 genera), Daceloninæ (12 currently recognized genera; probably one or two more definable).

Ramphalcyon is the only genus in regard to the position of which there can be any uncertainty. It is here placed in the Daceloninæ, which I believe to be its proper place; the only alternative is to create an additional subfamily for it.

The Cerylinæ constitute a well-defined group separated from the two other subfamilies by a number of excellent characters. These are carried to an extreme in *Megaceryle* which is also characterized by several remarkable peculiarities in which it differs not only from *Ceryle* and *Chloroceryle* but from every other genus in the family. These characters are both external and internal, but the latter are not known in *Ceryle* which may prove to be somewhat intermediate between the two related genera in its osteology and myology as it is in several external features.

The Alcedininæ combine some of the characters of the Cerylinæ with others of the Daceloninæ, and possess several marked peculiarities of their own. They are less closely related to the Cerylinæ and more closely to the Daceloninæ than usually considered.

The current names *Sauromarptis* and *Carcineutes* must be replaced by *Choucalcyon* [1] and *Lacedo* [2] respectively. Both the older names were rejected on grounds of purism. *Dacelo* and *Lacedo* are both anagrams of *Alcedo* and if the former is accepted the latter must be also.

CLASSIFICATION ADOPTED.

The classification here adopted is set forth below. It should be understood that no attempt has been made to revise the genera of the second and third subfamilies; also that the order of genera in the Daceloninæ — the same as that of Sharpe's Hand-List (with the addition of *Ramphalcyon*)— while unsatisfactory is probably as good as any that can be devised with our present knowledge and perhaps as natural as any linear arrangement can be.

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[1] Lesson, Traité D'Orn., 1831, 248. Type by subsequent designation (Gray, 1855), *Alcedo gaudichaud* Quoy et Gaim. This genus originally contained two species: (1) *C. gaudichaldii*, (2) *C. australe*. The second species is the same as *Dacelo gigantea* (Latham), which is equivalent to *D. gigas* (Bodd.), the type (by monotypy) of *Dacelo* Leach, 1815.

[2] Reichenbach, Handbuch, Alced., 1851, 41. Type by subsequent designation (Gray, 1855), *Dacelo pulchella* Horsfield.

ALCEDINIDÆ.

Cerylinæ.

Megaceryle	Chloroceryle
Ceryle	

Alcedininæ.

Alcedo	Ceycopsis
Corythornis	Ispidina
Alcyone	Myioceyx
Ceyx	

Dalcelonincæ.

Syma	Ramphalcyon
Lacedo	Halcyon
Melidora	Todirhamphus
Clytoceyx	Cittura
Dacelo	Monachalcyon
Choucalcyon	Tanysiptera

CLASSIFICATIONS OF SHARPE AND SUNDEVALL.

The classification of the Alcedinidæ currently recognized is that of Sharpe's 'Hand-List of Birds,' and this is based on his 'Monograph of the Kingfishers' published in 1871.

This author recognized two subfamilies, Alcedininæ and Daceloninæ. The former comprises *Ramphalcyon*, *Ceryle* (including *Chloroceryle* and *Megaceryle*), and the three genera of small, short-tailed species with compressed bills, *Alcedo*, *Corythornis* and *Alcyone*. The four genera of small, short-tailed forms with broader bills are placed with the remaining genera in the Daceloninæ.

Ramphalcyon is an isolated genus, and its exact position is still somewhat uncertain, but from consideration of both its internal and its external structure I believe it much more naturally located in the Daceloninæ than next to *Ceryle* (or *Alcedo*) to which its resemblances, I believe, are largely due to convergence.

The separation of the genera of the *Alcedo-Myioceyx* group in two subfamilies is, in my opinion, altogether artificial and unnatural. The close interrelationship of all these genera is indicated by their strong mutual resemblances in size, color, and form (particularly the dorsal feathering, the very short tail, and the proportionate length of the toes), and it is quite evident that the breadth of the bill alone is insufficient for more than generic definition. Furthermore, the two groups are nearly, if not quite, connected by certain species of *Ceyx* and *Alcyone*, while *Ispidina leucogaster* is said by Sharpe to approach *Corythornis*.

These seven genera taken together appear to be sufficiently well characterized to form a subfamily of their own, combining to some extent certain characters of the two other subfamilies but possessing several peculiar to this group.

The arrangement of subfamilies here proposed resembles that of Sundevall much more than it does that of Sharpe, differing from the classification of the former author only in the separation of the Cerylinæ from the Alcedininæ. Sundevall, as did Cabanis and Heine, placed *Ramphalcyon* with the Daceloninæ. The primary division in Sundevall's classification is based on the size of the scapulars. In the Halcyoninæ (= Daceloninæ) these are said to be "large, forming a mantle, which hides the whole of the back," while in the Alcedininæ the scapulars are said to be "small, not hiding the back."

As shown beyond, the conspicuousness of the dorsal plumage in *Alcedo* and related genera is due largely to the fact that the dorsal tract is continuous and equally developed, all the feathers much elongated. In the Daceloninæ the dorsal feathers are much shorter. At the same time, however, in some at least of the genera of the latter group, the scapulars are unusually well developed.

DIAGNOSES OF THE SUBFAMILIES.

The three subfamilies proposed may be diagnosed as follows. As the osteological characters are known in but few genera, and some of them will probably prove inconstant, they are not enumerated in the diagnoses but are given in detail beyond.

Cerylinæ.— Alcedinidæ of both hemispheres, unrepresented in the Australian Region or in the Indo-Malayan subregion, the bill long or rather long, compressed, the tenth primary always longer than the fourth except in some specimens of one subspecies (*C. ænea*), the tail of moderate length or rather long (much more than half the length of the wing), the lower end of the tibia completely bare for a distance equal to or greater than the short chord[1] of the hallux claw (sometimes for slightly less in individuals of one or two species — *C. ænea* and *M. lugubris*), the tarsus short or extremely short, shorter than or equal to the inner toe without claw (sometimes in one species, *C. ænea*, slightly longer) the toes short or very short, the second toe relatively longer than the others, being (with its claw) never shorter than the third toe without claw by as much as the short chord of the claw of toe No. 2, and usually equal to or longer than the fourth toe without claw (sometimes a trifle shorter); the dorsal tract somewhat interrupted anteriorly; the bill is never wholly or largely red or yellow, the plumage wholly without changeable blue, the entire upper surface including wings and tail of one ground color or pattern (in each species), the remiges or rectrices always marked with white, the sex never indicated by the coloration of the upperparts but always by that of the underparts, the chest of the male always rufous when, as usual, it differs in color from that of the female (which is never rufous).

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[1] *I. e.*, from tip to base of *lower* side of claw.

Alcedininæ.—Small or very small Old World Alcedinidæ, with the tenth primary never shorter than the fifth, the tail very short (less than half the length of the wing), the bare space at lower end of tibia shorter than the short chord of the hallux claw on at least the outer side of the tibia, the tarsus rather short but always decidedly longer than the inner toe without claw, the third and fourth toes long, the second short, greatly reduced or absent, always (with its claw) much shorter than the third and fourth toes, without claws (by more than the short chord of the claw of toe No. 2); the dorsal tract perfectly continuous, the feathers being long and conspicuous, the plumage always with more or less blue or violaceous, the crown spotted or barred with blue (in at least some of the species of each genus), the upperparts, remiges or rectrices without spots, bars, or conspicuous areas of white, the sexes alike in the color of the upperparts, but occasionally unlike beneath.

The Alcedininæ may be distinguished from both of the other subfamilies at once by the following brief diagnosis: Small, very short-tailed Kingfishers, with all the feathers of the dorsal tract elongated, the second toe very short or absent, the orbital process of the quadrate practically wanting. (The last character possibly inconstant.)

Daceloninæ.— Rather small to very large Alcedinidæ restricted to the Old World and, with the exception of one genus, to the Australian and Indian Regions, with the tenth primary usually much shorter than the fifth (longer only in certain species of *Halcyon*), the tail long or rather long (rather short in one species of *Halcyon* but always more than half as long as the wing), the tibia feathered to its extreme lower end (partly bare in *Ramphalcyon*, but the bare space on outer side much shorter than the short chord of the hallux claw), the tarsus relatively rather long or long (decidedly longer than inner toe without claw), or (in *Ramphalcyon*) rather short (equalling or a trifle exceeding the inner toe without claw), the toes long, the second toe with claw shorter than the third without claw (but never by more than the short chord of claw of toe No. 2), and shorter than or barely equal to the fourth toe without claw (these toe proportions not holding in *Lacedo*); the dorsal tract interrupted near its anterior end; the plumage always with blue or greenish blue, the primaries never spotted or barred with white and the secondaries and scapulars thus marked only in *Lacedo*, the sexes usually differing more or less in the color of the upperparts or tail, rarely (in a few species of *Halcyon* and in *Lacedo*) in the color of the underparts.

TABLE OF SUBFAMILY CHARACTERS.

In the accompanying table (page 245) the characters peculiar to any one subfamily are given in italics.

RELATIVE DEVELOPMENT OF CHARACTERS IN THE GENERA AND SUBFAMILIES.

In the following table the genera and subfamilies are arranged according to the development of the various characters in each. It is evident that the Cerylinæ, particularly *Megaceryle*, represent one extreme in the majority of cases, while in several respects the Alcedininæ are the most divergent.

Characters of the Three Subfamilies of Kingfishers.

	CERYLINÆ	ALCEDININÆ	DACELONINÆ
Bill	Long; compressed, often deep	Long, not deep	Extremely variable
Crest	*Narrow*, of narrow feathers	Flat	Wide, flat, usually of broad feathers
10th primary	> 3 (> 5 except 2 sps. of *Chloroceryle*)	= or > 5	< 5 except in some *Halcyons* (usually = or < 3)
Length of tail	Moderate	*Very short*	Moderate or long (rather short in *Halcyon concretus*)
Dorsal tract	Interrupted; feathers rather long	*Continuous; feathers long*	Interrupted; feathers moderate to short
End of tibia	*Completely bare*	Intermediate	Feathered (*Ramphalcyon* intermediate)
Length of tarsus	Short to very short	Rather short	Moderate to rather long (short in *Ramphalcyon*)
Third and fourth toes	Short to very short	Long to moderate	Long to moderate
Second toe	Long (moderate in 3 sps. of *Chloroceryle*	*Short, vestigial or absent*	Moderate to rather short (long in *Lacedo*)
Tuft of oil-gland	Large	Large	Large in *Halcyon*, etc.; smallish to absent in 6 genera
General coloration	*No blue;* one pattern above	Blue present	Blue present; often 2 or more patterns above
Crown	Not marked as in Alcedininæ	*Barred or spotted with blue*	Not marked as in Alcedininæ
Wings and tail	*Spotted or barred*	Never spotted or barred	Not spotted or barred (except in two genera)
Sexual coloration	Alike above, *always different below*	Alike above, rarely different below	*Usually different above*, rarely different below
Nostril (in bone)	Short	Long	Long (*Ramphalcyon* intermediate)
Maxillary	*Conspicuously expanded*	Not expanded	Not expanded
Palatal spine	*Vestigial or short*	Long (*Alcedo*)	Long (*Dacelo*)
Orbital proc. of quadrate	*Weak, pointed*	*Virtually absent*	*Strong, thick, blunt*
Pars plana and d.p. of lacrymal	Meet near upper corner	Meet near middle	Meet below middle (*Ramphalcyon* peculiar)
Procoracoid	Smaller	*United with acrocoracoid*	Smaller
Clavicle process	*Absent* or rather small and gradual	Large and abrupt (blunt)	Large and abrupt (pointed)
Iliac process	Well developed	?	Vestigial
Geog. distribution	Both Hemispheres, not in Australian or Indo-Malayan.	E. Hemisphere, one slight genus restricted to Australian Region	E. Hemisphere, restricted to Australian Region except 2 genera

Iliac process	Megaceryle, large. Chloroceryle, smaller. Daceloninæ, vestigial.
Maxillary	Megaceryle } Chloroceryle } conspicuously expanded. Ramphalcyon, *slightly* approaching Cerylinæ. Daceloninæ (part), Alcedininæ, not expanded.
Post-palatal spine	Megaceryle, vestigial. Chloroceryle, short. Dacelo, long. Alcedo, very long.
Clavicle process	Megaceryle, absent. Chloroceryle, moderate. Alcedo, Daceloninæ, large.
Orbital process of quadrate	Alcedo, absent. Chloroceryle, slender, sharp. Megaceryle, sharp. Daceloninæ, stout, blunt.
Junction of pars plana and d. p. of lacrymal	Megaceryle, upper corner. Chloroceryle, near upper corner. Alcedo, above middle. Halcyon, Dacelo, below middle.
Tibial feathering	Cerylinæ, conspicuously bare all around. Alcedininæ, average (some like Ramphalcyon, some like Daceloninæ). Ramphalcyon, bare in front, feathered on inside. Daceloninæ, feathered to or beyond joint.
Length of tarsus	Megaceryle, extremely short. Chloroceryle, Ceryle, Ramphalcyon, short. Alcedininæ, slightly longer. Daceloninæ, relatively rather long and long.
Length of 2nd toe	Megaceryle, Ceryle, Chloroceryle amazona, Lacedo, long. Chloroceryle (3 species), Daceloninæ (exc. Lacedo), medium or rather short. Alcedininæ, short, vestigial or absent.
10th Primary	Halcyon, part, = 9. Cerylinæ (exc. 2 Chloroceryle), Alcedininæ, Halcyon, part, = or > 5. Chloroceryle, 2 species, Dacelo, Todirhamphus, Halcyon, part, > 3 to = 5. Daceloninæ, 9 genera + Halcyon, part, = or < 3, often < 1.
Length of tail	Alcedininæ, very short. Halcyon concretus, short. Cerylinæ, Daceloninæ, part, moderate. Daceloninæ, part, long.

Dorsal tract	Alcedininæ, continuous, all feathers long.	
	Cerylinæ, feathers moderate, short in interscapular spot.	
	Daceloninæ, part, feathers shorter, short in interscapular spot.	
	Daceloninæ, part, practically bare in interscapular spot.	
	Ramphalcyon, dorsal feathers all very short.	
Oil-gland tuft	Cerylinæ, Alcedininæ, Daceloninæ, part, large or moderate.	
	Monachalcyon, Clytoceyx, rather small	Daceloninæ, part.
	Lacedo, Melidora, vestigial	
	Cittura, Tanysiptera, absent	
Sexual coloration	Cerylinæ, Alcedininæ, few, Halcyon, few (different below).	
	Lacedo, (different below and above).	
	Alcedininæ, most, Halcyon, most, Todirhamphus, Ramphalcyon, Tanysiptera, most, (scarcely or not different).	
	Daceloninæ, most, including Halcyon, few, (different above).	

CHARACTERS OF SUBFAMILIES IN DETAIL.

The characters of the subfamilies in greater detail are given below.

Cerylinæ (3 genera).—The only subfamily represented in the Western Hemisphere, to which one of the genera is restricted. It is wholly absent from the Australian Region, New Zealand, the Philippines, East Indies and Europe.

Size exceedingly variable, one of the species almost as small and two nearly as large as the extremes in the family. Bill long or rather long, compressed; the proximal half of the culmen may be flattened but is not expanded basally as in *Ramphalcyon;* the gonys not keeled as in the latter genus.

A crest always present; short, blended, occipital; longer, less blended, occipital, or (in one genus) large, conspicuous, compressed, occipital and vertical, with linear or narrowly linear lanceolate feathers. It is always narrow, unlike the wide flat crest of Daceloninæ and *Corythornis*.

The tenth primary is never shorter than the third, and is always longer than the fourth except in some individuals of one species; longer than the seventh in only one species (in which it is often less).

Tail rather long (always much more than half as long as the wing), graduated for one fifth of its length or less, sometimes nearly even.

The lower end of the tibio-tarsus is not feathered to the joint on any side and in front is conspicuously bare. This unfeathered space at its most restricted point always at least equals the short chord of the claw of the hallux, except in some examples of one or two species.

The tarsus and hallux are short, extremely short in *Megaceryle* which stands alone in the family in this respect.

In the other genera the tarsus is shorter than that of any of the Daceloninæ except *Ramphalcyon* and slightly shorter than most if not all of the Alcedininæ.

All the toes are short (particularly in *Megaceryle* and *Ceryle*) differing from both other subfamilies. The second toe is moderate or long compared with the other anterior toes.

The second toe with claw is usually equal to or longer than the fourth toe without claw, sometimes a *trifle* shorter; and equal to or longer than the third or slightly shorter, never falling short of the third by as much as the short chord of the claw of toe No. 2.

The bill is always black, the lower mandible partially paler (probably orange in life) basally in two species of *Chloroceryle*. These are also the only species with red or orange feet. The dorsal feather tract is intermediate in character between that of the two other subfamilies. It is interrupted in the interscapular region as in the Daceloninæ but somewhat less conspicuously so. The feathers of the lower back and rump are longer and more fully developed than in the latter group, but shorter than in the Alcedininæ.

The Cerylinæ are wholly without the blue or greenish blue present in every genus of the two other subfamilies and very characteristic of them. The upper parts are glossy, metallic green in *Chloroceryle*, lustreless black and white or gray and white or wholly bluish gray in the two other genera.

In each species the entire upper parts including the crown, wings and tail are always of one color or style of coloration — *i. e.*, the ground color is similar throughout and any variegation takes the form of markings on the individual feathers, no large areas of a different color being present.

The inner webs of the primaries are usually spotted or indented with white. This is more or less marked in all species except *Ceryle rudis* in which the large white patches give no indication of being broken up into spots, and in *C. ænea* in which the inner webs are plain, or at most with a fulvous margin. The outer webs of the primaries are also usually marked with white. The secondaries and scapulars are always more or less spotted or indented and the rectrices barred or otherwise marked with white.

The sex in all three genera is invariably indicated by the color of the underparts (and never by that of the upperparts or tail), particularly by the chest or breast band. In both sexes the chest is crossed by a band which is of the same color as the upperparts (females of *all* species, and males of two), or rufous (males of all species except two), though in the rufous bellied species the rufous of the chest is continuous with that of the breast and belly. Thus the *color of the chest-band* usually distinguishes the sexes (always in *Chloroceryle,* never in *Ceryle*). In one species of *Chloroceryle* the sexes also differ in the color of the throat and breast. In all the species of *Megaceryle* the males may be distinguished from the females by the color of the axillars and (except in one species) by that of the under wing-coverts, while in two species there is also a difference in the color of the belly. While the female never has rufous on the chest and in *Megaceryle* and *Chloroceryle* the male (with one exception) is always rufous there, when there is a difference in the color of the axillars, under wing-coverts, throat, breast or belly as above noted the coloration is reversed, and where the male is white the female is rufous or buff. *Ceryle,* unique in the absence of rufous in both sexes, is also peculiar in having two black bands across the breast of the male.

Outside of the Cerylinæ a sexual difference in the color of the underparts occurs in only two or three species of Alcedininæ (*Alcedo* and *Alcyone*) and in *Lacedo* and one section of *Halcyon* of the Daceloninæ. In none of these, however (except in *Lacedo*) are the differences of the same nature as in *Megaceryle* and *Chloroceryle* (or *Ceryle*) and they have therefore undoubtedly been independently acquired and do not indicate any particular affinity to the Cerylinæ, nor weaken the value of this character in the latter group.

The oil-gland always has a well developed tuft in this subfamily. The secondaries are eutaxic in *Chloroceryle,* diastataxic in the two other genera.

Several other miscellaneous "negative" characters may be mentioned, each of which serves to distinguish this group from one or more genera of the other subfamilies. The bill is never wholly red, and the culmen is not hooked. The feathering of the lores is normal or not very remarkable, never bare or bristly; the number of rectrices is always twelve and the central pair is never elongated beyond the others. The second toe is always present and well developed.

The following osteological characters are, as previously mentioned, based on only a few species (belonging to six genera[1]) and doubtless will not all prove to be constant distinctions between the Cerylinæ and the other subfamilies.

The culmen is not depressed back of the nostrils, and the latter are comparatively short not reaching very far backwards. The mesethmoid is produced anteriorly in a more or less triangular or pointed plate. The pars plana of the mesethmoid meets the descending process of the lacrymal decidedly above the middle of the latter, sometimes at the upper corner. The lacrymal is rather narrowly oblong and has no backwardly produced process. The maxillary is conspicuously expanded into a thin, flat plate. The posterior palatal spine is vestigial or short. The orbital process of the quadrate is long or rather long, slender and pointed. The sternum is relatively long and narrow, the coracoids and furcula short, the last much wider toward the upper end. The pointed process arising from the upper end of the clavicle is either moderately developed or wholly absent. The sternal keel is high and prominent. The scapula is not broadened at the bend near its distal end, and without a prominent angle on the inner side at that point. The pelvis is wide and ample without abrupt angles; the ilia narrowed anteriorly, their inner edges not sharply defined and not separated by a deep groove from the sacrum, and the latter is flattened on top. The ilia bears a small pointed process on its margin. (Plates XXV and XXVI.)

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[1] *Megaceryle. Chloroceryle, Alcedo* (skull), ***Ramphalcyon, Halcyon, Dacelo.***

Alcedininæ (7 genera).— Restricted to the Eastern Hemisphere; one weakly characterized genus confined to the Celebes, three to Africa, the others chiefly Austro-Malayan and Asiatic.

Size rather uniform, small to very small. Bill long or rather long, varying from compressed to much depressed or flattened. Culmen not flattened and expanded basally as in *Ramphalcyon*. The vertical crest when present (as in *Corythornis*) differs in form and in the shape of the individual feathers from that of *Megaceryle*, the crest being wide and depressed, the feathers linear-oblanceolate or somewhat clavate. In the species examined (representing all the genera) the tenth primary is never shorter than the fifth, and is sometimes equal to the seventh. The tail is very short (always less than half the length of the wing) and of remarkably uniform length throughout the group. In this respect the subfamily is unique.

The lower end of the tibia is more extensively feathered than in the *Cerylinæ*, the feathers extending to the joint in at least three genera. *Alcedo* and *Alcyone* are intermediate, there being a decided bare space in front, above the joint, in at least some species; but on the outer side or rear of the tibia, if not in front, the feathers always extend further down than in the Cerylinæ, the bare space at its most restricted point being shorter than the short chord of the hallux claw.

The tarsus is always short or rather short, always decidedly longer than that of *Megaceryle* but never as long as in the longer-legged genera of Daceloninæ. It is slightly longer than in *Chloroceryle* and about equal to the shorter-legged forms of Daceloninæ (excluding *Ramphalcyon*). The tarsus is always decidedly longer than the inner toe without claw.

The anterior toes (except the second) are longer than in the Cerylinæ agreeing better with the Daceloninæ. The second toe with claw is always much shorter than the third toe without claw (by at least a trifle more than the chord of the claw of toe No. 2); it is sometimes markedly reduced and in two genera wholly absent or represented by a mere vestige. It is thus decidedly shorter than in the Cerylinæ and, with the possible exception of a few species of *Halcyon*, always shorter than in the Daceloninæ.

The bill in at least some species of every genus is more or less red, at least five of the seven genera containing species with wholly red bills. The feet also are usually red or orange, this coloration represented in every genus.

The dorsal feather tract differs decidedly from that of the two other subfamilies in being perfectly continuous, not interrupted in the interscapular region. The feathers of the lower back and rump also are very long, more so even than in the Cerylinæ, and conspicuous, not hidden by the scapulars as in the Daceloninæ.

In all the species the characteristic blue of the Kingfishers (except the Cerylinæ) is present, varying, as in the Daceloninæ, from deep blue to a light silky opalescent or greenish blue.

The upperparts are almost limited to these shades though sometimes invaded by rufous which in a few species overspreads the entire upper surface. In the latter the blue is represented by a strong lilaceous luster.

Nearly as universal as blue is rufous, which is found on the underparts in at least some species of each genus. The scapulars, remiges or rectrices are never spotted, barred or otherwise marked with white.

The crown is often barred or spotted with black on a blue ground, or with light blue on a dark blue or blackish ground. This runs through the various genera and is very characteristic of the group.

There is, ordinarily, little if any sexual difference in the color of the plumage. The sex is never indicated by the color of the upperparts or tail, as in some Daceloninæ, except that the female may be duller and greener above as in *Ramphalcyon*, and rarely by the banding of the chest or general color of the underparts as in the Cerylinæ. In at least two species, however, the male has a blue chest-band which is absent in the female. This is the case in *Alcyone cyanopectus* in which the blue of the sides and flanks is also more extensive in the male, and in *Alcedo euryzona* in which the ground color of the underparts is white in the male and (except the throat) ochraceous-rufous in the female. Thus in these species the color of the chest-band is exactly the reverse of the normal Cerylinæ style.

In *Alcedo euryzona*, however, the general color of the posterior underparts in each sex (white in male, rufous in female) is the same as in *Megaceryle maxima* and to a less extent in *M. alcyon*. This, however, can scarcely be considered as other than a chance resemblance or more properly a case of parallel development or convergence. Only one other species of Alcedininæ appears to have a banded chest. This is *Alcedo beryllina* in which the underparts are white with a blue chest-band in both sexes.

In all the species of *Alcedo* there is a curious difference in the color of the bill according to the sex. This is wholly black in the males while in the females more or less of the proximal half of the lower mandible is red.

The tuft of the oil-gland is always well developed. The status of the fifth secondary has been recorded only in *Alcedo* (2 species) and *Ceyx*. These are both eutaxic, and in all probability the other genera are the same.

Of miscellaneous characters may be mentioned the color of the bill, which is often entirely red; the tomia are always smooth, and the tip of the maxilla is never hooked. The loral feathering is normal and the rectrices always number twelve.

The osteological characters are presumably rather uniform throughout the group, but unfortunately I have had for examination only the skull of *Alcedo ispida*, and the following notes are based on this species.

The culmen is not depressed back of the nostrils and the latter are longer and extend further back than in the Cerylinæ, agreeing better with the Daceloninæ. The mesethmoid projects somewhat anteriorly, most resembling the Cerylinæ in this feature. The pars plana of the mesethmoid meets the descending process of the lacrymal a trifle above the middle, being thus intermediate between the Cerylinæ on one hand and *Dacelo* and *Halcyon* on the other. The lacrymal is shorter than that of the Cerylinæ but agrees in its truncate posterior margin, and is not at all produced backwards as in *Dacelo* and *Ramphalcyon.*

The maxillary is not conspicuously expanded, agreeing with the Daceloninæ and differing from the Cerylinæ. The posterior palatal spine is long and slender, much like that of Dacelo but even longer and very different from that of *Chloroceryle* and *Megaceryle.* (In the skulls of *Ramphalcyon* and *Halcyon* examined the palatines are imperfect and this character cannot be determined.) (Plate XXV, Fig. 1.)

The orbital process of the quadrate is remarkably short and blunt. This condition is very different from that found in most genera, but is doubtless most closely related to that seen in *Chloroceryle* (in *C. americana* more than in *C. amazona*) in which the orbital process is a very slender spine. The disappearance of this spine would result in a quadrate much like that of *Alcedo.*

As no part of the body skeleton has been available for examination, I am unable to describe the sternum, shoulder girdle or pelvis in detail. Fürbringer's figures, however, show that there is a process near the proximal end of the clavicle as in *Halcyon*, *Dacelo*, etc., but even larger and more abrupt, differing in being broad and rounded terminally instead of triangular and pointed. Fürbringer states that in this genus the procoracoid is united with the acrocoracoid by a bony bridge. This peculiarity is probably confined to the present subfamily.

The figures of the sternum show that the keel is high and prominent but less so than in *Megaceryle* (more as in *Chloroceryle*), the upper or anterior end decidedly concave as in all the genera examined except *Megaceryle*.

Daceloninæ (at least 12 genera).— Restricted to the Old World and, with the exception of the large and widely distributed genus *Halcyon*, to the Australian and Indian Regions. Only two other genera (*Ramphalcyon* and *Lacedo*) are found at all outside of the Australian Region and these are mostly confined to the Indo-Malayan subregion. *Lacedo* is the only one of the group not represented in the Australian Region.

Size rather small to very large, the smallest species about equalling the largest species of the Alcedininæ.

Bill extremely variable in length and general shape, varying from long to very short, and from very deep to much depressed, but compressed only in *Ramphalcyon*. In all the others except *Halcyon* the form of the bill is decidedly different from that found in the other subfamilies and in some, as *Cittura* and *Clytoceyx*, it is remarkably modified.

The occipital feathers are always more or less lengthened, though slightly so in *Ramphalcyon* and many *Halcyons*. Often, as in *Dacelo*, *Melidora*, *Clytoceyx* and *Monachalcyon*, the feathers of both the occiput and vertex are considerably elongated and form a wide flat crest, quite different from the narrow crest of the *Cerylinæ*. There is nothing approaching the high, compressed vertical crest of *Megaceryle*, nor the peculiar form found in *Corythornis*. The feathers are usually broad and rounded at the tip.

The wing is usually decidedly rounded. In some species of *Halcyon* the tenth primary is as long as the ninth, these two quills being the longest, but in all other genera the outermost quill is shorter than the fifth, usually conspicuously so, and shorter than the fourth in all but *Todirhamphus* and *Dacelo*.

With the exception, therefore, of *Halcyon* the Daceloninæ differ in this respect from all the Alcedininæ and from the Cerylinæ except certain species of *Chloroceryle*.

The variation in the primary formula in *Halcyon* is most remarkbale. The tenth primary is in some species much shorter than the first, while in others the tenth and ninth are equal and longest. There are doubtless few if any other genera of birds in which this range of variation is equalled. There is little doubt, however, that this large genus of over eighty forms, by far the largest in the family, is divisible into at least two genera as it includes both crested and noncrested groups, and there are also differences in form and extension.

The tail is always rather long or long (rather short in Halcyon concretus), but always more than half the length of the wing, and attains the greatest length in the family in *Cittura*, *Monachalcyon* and *Tanysiptera*, in which it is nearly as long as the wing. The last genus is unique in the presence of only ten rectrices, the middle pair greatly elongated, linear, widening at the tip. In four genera — *Tanysiptera*, *Cittura*, *Lacedo* and *Syma* — the tail is graduated for one third or more of its length (leaving out of account the central rectrices of *Tanysiptera*).

The lower end of the tibia is always completely feathered to the joint except in *Ramphalcyon*, which is intermediate between the other genera and the Cerylinæ in this respect, the lower end of the tibia being bare in front for more than in any other non-Cerylinæ genus (for a distance about equal to or longer than the short chord of the hallux claw), but on the outside it is bare for much less than this distance, thus differing from the Cerylinæ.

In the following genera the feathers extend beyond the joint, small feathers growing on the upper end of the tarsus: *Clytoceyx*, *Lacedo*, *Syma*, *Cittura*, *Dacelo*, *Choucalcyon*, and some species of *Halcyon*. In *Melidora* the feathers fall over and beyond the joint. In all the other genera except *Ramphalcyon* the feathering extends right down to the joint, densely in all the species of *Halcyon* examined, but sparsely in *Monachalcyon*.

The tarsus is comparatively long in all except *Ramphalcyon*, in which it is of about the same length as in *Chloroceryle*, equalling or a trifle exceeding the inner toe without the claw. In all the other genera the tarsus is decidedly longer than the inner toe without claw, sometimes (*Clytoceyx*, *Monachalcyon*, *Tanysiptera* and *Syma*) equalling or exceeding the toe and claw combined.

The following measurements, in millimeters, all taken from the bones, show well the relative length of the tarsus in several genera:

	Tarsus	*Femur*
Megaceryle torquata	12.6	33.4
Chloroceryle americana	9.3	17.5
Ramphalcyon capensis	15.	29.
Halcyon chloris	14.	21.9
Dacelo gigas	24.	37.4

It will be observed that in *Megaceryle* the tarsus is much less than half the length of the femur; in *Chloroceryle* and *Ramphalcyon* a trifle more than half; in *Halcyon* and *Dacelo* much more than half.

The second toe with claw is always (excepting in *Lacedo*) shorter than the third toe without claw, though sometimes only a trifle shorter. The sole exception to this very uniform proportion is *Lacedo,* in which the second toe slightly exceeds the third (thus agreeing with *Megaceryle*). The second toe (with claw) is, however, never much shorter than the third (without claw), as is the case in all the Alcedininæ, never falling short of the third by more than the short chord of the claw of toe No. 2, except probably in *Halcyon coromandus* and possibly a few other species. The second (with claw) is always (again excepting *Lacedo*) distinctly shorter than the fourth (without claw) or barely equal to it. In *Lacedo* the second is a trifle longer than the fourth.

Thus in this subfamily the second toe is relatively longer than in the Alcedininæ and shorter than in most Cerylinæ; but *Lacedo* agrees with the latter, while the two or three small species of *Chloroceryle* agree with the Daceloninæ.

The dorsal feather tract resembles that of the Cerylinæ in being interrupted by a spot on the interscapulum in which the feathers are very short. This is carried to the extreme in the present group, as, in most genera, this area is conspicuously bare, with only a few small downy feathers growing in it. In several genera as in *Ramphalcyon, Halcyon* and *Dacelo* the tract is continuous, a single line of small, weak feathers connecting the anterior and posterior parts of the tract. In *Ramphalcyon* and to a greater or less extent in *Halcyon* and *Dacelo* this interscapular spot is densely covered with down.

The feathers of the lower back and rump are shorter than in the Cerylinæ, but there is some variation in their length in the different genera. In *Ramphalcyon* all the dorsal feathers are notably short.

The bill is very rarely entirely black and in the majority of genera is wholly red or yellowish in at least some species. (This is also the case in the Alcedininæ but never in the Cerylinæ.)

In every genus of this group, and indeed in every species (at least of those examined) the characteristic blue or greenish blue is present, though occasionally hardly more than a trace is evident.

The rectrices are barred only in *Dacelo* and *Lacedo,* and the remiges and scapulars only in the latter, the entire upperparts of which are barred. The crown never exhibits the blue banding or spotting so characteristic of the Alcedininæ.

In all but two genera (*Ramphalcyon* and *Todirhamphus*) in some species at least, the sexes differ more or less from each other in the color of some part or parts of the upper surface (including crown, cheeks, wing-coverts, and particularly the tail) which are usually blue in the male, this wholly or partly replaced by rufous or, less frequently, black in the female. *Syma* is peculiar in having the head cinnamon in the male, and with a large black patch in the center of the crown in the female.

Differences in coloration of this nature are wholly absent in the Cerylinæ and Alcedininæ. Moreover in the Daceloninæ (excepting in a few species of *Halcyon* and in *Lacedo*) the sexes never differ in the color of the underparts as do those of the Cerylinæ, no chest-band being present.

Lacedo, in addition to presenting greater sexual differences in the color of the upper parts than in any other genus also differs in the color of the underparts almost exactly as do the species of *Megaceryle* and *Chloroceryle*. In the male the breast and sides are fulvous or ochraceous-buff, while in the female these parts are almost white, narrowly barred with black.

In *Tanysiptera* the sexes are described as similar except in *T. sylvia* in which the female has a buff instead of white dorsal patch and the proximal portion of the outer web of the central rectrices blue (wholly white in the male).

In *Halcyon* the sexes are usually alike, the female sometimes somewhat duller in color but there are well marked differences in two groups of the genus. In *H. concretus* and *H. lindsayi* the distinction is much as in the majority of genera of the subfamily, blue on the upperparts of the male being replaced by greenish in the female.

In the group containing *H. lazuli* and several other species the sexes differ in the distribution of blue and white on the underparts or the presence or absence of a white collar, or in both respects. The male may be entirely white or entirely blue below, the female white with a blue chest-band, or the abdomen may be blue in the male and white in the female.

In *H. albiventris*, which belongs to another group, the female is said to be much duller than the male (black above replaced by brown), the blue parts greener, the white or buff of the hind neck and portions of the under surface deeper buff or more rufescent.

In *Todirhamphus* there appears to be no sexual difference. This genus is closely related to *Halcyon*, particularly to a section in which the sexes are alike.

In *Ramphalcyon* also the sexes differ in coloration only in the duller, more brownish or greenish (less blue) upperparts of the females, as in some species of *Halcyon*.[1] In this genus moreover the color pattern is as different as possible from that of the *Cerylinæ*, and both color and pattern agree much more closely with those of the Daceloninæ and Alcedininæ.

Skeletons of the following genera of Daceloninæ have been examined: *Dacelo*, *Halcyon* (*chloris*, and sternum and shoulder girdle of *concretus*), and

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[1] *Cf.* Oberholser, Proc. U. S. Nat. Mus., XXXV, 1909, 658.

Ramphalcyon. Unfortunately the palatines are imperfect in all the specimens except that of *Dacelo.* These have been compared with skeletons of *Megaceryle* (*alcyon* and *torquata*) and *Chloroceryle* (*americana,* and skull of *C. amazona*) representing the Cerylinæ, and skulls of *Alcedo ispida* (also figures of sternum and shoulder girdle) representing the Alcedininæ. It must be understood that the following statements refer only to the genera enumerated, and, as already remarked, some of the minor characters described will probably be found inconstant when all the genera are examined.

There is no reason to believe, however, that the essential characters of the Cerylinæ as here set forth will have to be changed when the osteology of *Ceryle rudis* has been investigated.

In the Daceloninæ the culmen is bent down or depressed at its base; this is not the case in the other groups.

The nostrils are long, extending far backwards, but *Ramphalcyon* is intermediate between *Dacelo* and *Halcyon* on one hand and the Cerylinæ on the other. *Alcedo* is little different from the Daceloninæ.

The mesethmoid is not produced forwards in a pointed plate as in *Megaceryle* and to a less extent in *Chloroceryle* and *Alcedo. C. amazona* apparently agrees with the Daceloninæ in this respect but I am not certain that this part of the skull is perfect in the specimens examined.

The pars plana of the mesethmoid meets the descending process of the lacrymal a little below the middle of the latter, not slightly above the middle as in *Alcedo* nor much above as in the Cerylinæ. In *Ramphalcyon* the descending process of the lacrymal is so peculiar that its relation to the pars plana cannot be easily compared with that in the other genera.

In *Dacelo* and *Ramphalcyon* the lacrymal has a conspicuous backward (superorbital) process, longer than the anterior part of the bone in the former, much shorter in the latter. This process is altogether absent in *Halcyon* (*chloris*), *Alcedo,* and the Cerylinæ.

The maxillary, as in *Alcedo,* is normal, not expanded into a plate as in the Cerylinæ. *Halcyon* is farthest from the latter, while *Ramphalcyon* shows a slight approach to the Cerylinæ type.

As above stated the palatines are imperfect in all the specimens of Daceloninæ examined except in *Dacelo.* In this genus, as in *Alcedo,* the posterior palatal spine is highly developed, being more than one-third the length of the pterygoids (nearer one-half in *Alcedo*). This process is vestigial in *Megaceryle* and short (about one-eighth the length of the pterygoids) in *Chloroceryle americana.*

In the fusion of the posterior portion of the palatines along their prominent internal laminæ *Ramphalcyon* resembles the Cerylinæ [1] (the union being even more extensive) and is quite different from *Dacelo* in which the internal laminæ are completely separated. *Halcyon* is somewhat intermediate, the extreme posterior ends being fused. In *Ramphalcyon*, however, the angle formed by the laminæ as they approach each other is wider and more rounded than it is in the *Cerylinæ*.

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[1] Shufeldt states that in *Megaceryle alcyon* "the interval between the anterior ends" of the palatines ("of about two millimeters") "is continued backwards to a point well within

In *Alcedo* the fusion of the post-palatines is nearly as in the *Cerylinæ*, but the internal laminæ are scarcely raised above the main expanse of the palatines, differing in this respect from the other groups examined. The palatines, however, agree with those of *Dacelo* and differ from the *Cerylinæ* in being nearly in one plane, while in the latter they slant strongly downwards from the median line towards the outer edge. (Plate XXV, fig. 1.)

The orbital process of the quadrate is very similar in the three genera of Daceloninæ examined, being stout throughout, blunt and thick at the distal end. In *Alcedo* it is extremely short and obtuse, in fact it might almost be said to be absent. In the Cerylinæ it is slender, tapering to a point anteriorly, being particularly slender and weak in *Chloroceryle*, evidently approaching the condition found in *Alcedo*.

The sternum averages shorter and wider than that of the Cerylinæ, the coracoids and furcula longer. This is conspicuously so in *Halcyon concretus*, while *Megaceryle* is the other extreme.

The process arising from the clavicle, near its upper end, is abrupt and large as in *Alcedo* (but pointed rather than broadly rounded terminally as in the latter). This process is smaller and less abrupt in *Chloroceryle*, absent in *Megaceryle*. (Plate XXVI, fig. 1.)

The sternal keel as in all the genera examined except *Megaceryle* is concave on its anterior (or upper) end (most so in *Halcyon*), and comparatively low. (Plate XXVI, fig. 2.) In none of the genera examined is the precoracoid united with the acrocoracoid by a bony bridge as in *Alcedo*. The foot of the coracoid is normal, without the curious upstanding process on the inner edge found in *Megaceryle*. The scapula, unlike that of the Cerylinæ, is widened at the bend and with a prominent angle on the inner side at that point. (Plate XXVI. fig. 1.)

The anterior end of the pelvis differs from that of the Cerylinæ as described under that subfamily, but in *Ramphalcyon* there is some resemblance in the ilia to the Cerylinæ. There is only a slight indication of the

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the articulation of the heads that articulate with the pterygoids." This condition is shown in the figure accompanying Shufeldt's article, the internal laminæ of the palatines being separated to their extreme posterior ends. (Journal of Anatomy, Vol. XVIII, 1884, pp. 279–294; Amer. Naturalist, Vol. XXXVII, 1903, 707 and 708.)

In my opinion this description and figure must be erroneous for in the two skulls of *M. alcyon* and one of *M. torquata* examined by me, the posterior ends of the internal laminæ are solidly fused together for a distance of three mm. in the former species and five and one-half in the latter.

small process on the margin of the ilium which is better developed in *Chloroceryle* and conspicuous in *Megaceryle.*

THE POSITION OF RAMPHALCYON.

Fürbringer states that *Ramphalcyon* appears to occupy a special position and to connect the Alcedininæ (= Alcedininæ + Cerylinæ doubtless) with the Halcyoninæ (= Daceloninæ). He remarks that in external characters and the majority of osteological characters this genus agrees better with the Alcedininæ than with the Halcyoninæ, but that in some particular points of the osteology and particularly of the musculature it agrees better with the Halcyoninæ. Fürbringer states that if it were not for *Ramphalcyon* he would agree to the separation of the Alcedinidæ into two families, but that, as the matter stands, further investigations are required to settle the question.

I cannot agree with the statement that in external characters this genus agrees better with the Alcedininæ (of Fürbringer) than with the Halcyoninæ. As regards the skeletal resemblances the material available is too incomplete for positive conclusions yet I believe that *Ramphalcyon* is more distinct from the Cerylinæ than from the Daceloninæ (in the restricted sense).

The following tabulation of the characters of *Ramphalcyon* shows the grounds for placing this genus in the Daceloninæ. It agrees best with this subfamily in sixteen of the characters enumerated (also in several important muscular peculiarities), with the Alcedininæ in eight characters and with the Cerylinæ in five.

In almost all of the features in which *Megaceryle* and *Chloroceryle* differ from each other, *Ramphalcyon* more nearly agrees with the latter than with the former. This is the case not only in the characters here enumerated, but also in the sternal keel, the foot of the coracoid, and the crest, in all of which *Megaceryle* is highly specialized.

It is my belief that the resemblance in certain respects of *Ramphalcyon* to the Cerylinæ is due largely if not wholly to convergence caused by similarity of habits. These likenesses while more or less striking are imperfect, and the details in which they are imperfect are suggestive of analogy and not of common descent.

Thus the bill while compressed, though to a less extent than that of *Megaceryle*, differs in the form of the culmen, gonys and mandibular rami. The culmen is flattened and widened basally (unique), the gonys decidedly keeled (broader and flatter in the Cerylinæ). The mandibular rami are decidedly thinner and not conspicuously bent inwards as in the and form a rounded symphysis, not a narrow V-shaped angle as in the latter. The interramal space is broader, and the feathers (like those of the underparts in general) are less firm, dense and scale-like than in the Ceryline group. In all these respects the resemblance to certain Daceloninæ, for example *Halcyon pileatus*, is striking. The bill is of the same red color in that species as in two of the three species of *Ramphalcyon* (a feature unknown in the Cerylinæ), and except for the form of the culmen the bill of *Ramphalcyon* differs from that of *Halcyon* only in being more strikingly compressed. (Plate XXV, fig. 2.)

The loral feathering and the tibial feathering have both evidently been modified by the aquatic habits, yet in both respects there is a decided difference from the Cerylinæ. The feathers of the lores are extremely small and very closely appressed.

Neither the form of the wing nor the coloration are Ceryline, but much more Dacelonine. A significant point of resemblance between *Ramphalcyon* and the Daceloninæ is the nidification. Little has been published regarding the breeding of any of the species of this genus but it is certain, at least, that the nest is often placed in trees. McGregor describes a nest of *R. gouldi* "in a deserted termite's nest which was built approximately thirty feet from the ground, in a small dead stub. It was probably excavated by the birds, as there is no other way in which the hole could have been made." As far as is known all the members of the Cerylinæ invariably nest in holes excavated in sand or clay banks.

While some of the resemblances of *Ramphalcyon* to the Cerylinæ may be due to convergence, others are probably explainable by descent from a common ancestor, for the genus is unquestionably an old and isolated one. The short tarsus and fused palatines are two of the most important resemblances to the other piscivorous Kingfishers.

Of the differences from the Alcedininæ the most important are: length of second toe; proportion of primaries; character of dorsal feathering; form of lacrymal and of orbital process of quadrate; size; length of tail; and probably the form and arrangement of certain muscles.

Nearest Daceloninæ

Length of second toe (also agrees with aberrant Cerylinæ)
Proportion of primaries
Dorsal feathering (much nearer Cerylinæ than to Alcedininæ)
Gonys and mandibular rami (equally near Alcedininæ?)
Lacrymal (like *Dacelo;* unlike *Halcyon* which is like *Alcedo* and Cerylinæ)
Quadrate, orbital process
Base of culmen depressed (in skull)
Pelvis (that of *Alcedo* not seen)
Certain muscles (important)

Nearest Daceloninæ and Alcedininæ

General coloration (blue present, remiges and rectrices unmarked)
Sexual coloration (no difference below; no chest-band)
Length of third and fourth toes (little different from *Chloroceryle*)
Maxillary not expanded (*slightly* approaches Cerylinæ)
Proximal end of furcula (nearest Daceloninæ, not far from *Chloroceryle*)
Nidification

Nearest Daceloninæ and Cerylinæ

Length of tail
Size

Nearest Cerylinæ

Length of tarsus (like *Chloroceryle*)
Compressed bill (also deep)

Nearest Alcedininæ

Feathering of tibia (intermediate between Cerylinæ and Daceloninæ)

Nearest Alcedininæ and Cerylinæ

Fusion of palatines (even more extensive)

REMARKS ON OTHER GENERA.

While the question of generic distinction in the Alcedininæ and Daceloninæ is beyond the scope of the present paper, some random remarks on the subject suggest themselves and a few characters often overlooked in systematic works may be mentioned.

The very large and dominant genus *Halcyon* is remarkable not only for the great number of species (three or four times that of *Tanysiptera*, the next largest genus of Daceloninæ) and wide geographical distribution (the only genus of the subfamily found in Africa, where it is well represented), but also for the striking variations in the relative length of the primaries and the presence or absence of the fifth secondary.

Halcyon is evidently a generalized form and approaches the other subfamilies more closely than any other genus of its group. In the absence of a backward process to the lacrymal it differs from *Dacelo* and *Ramphalcyon* (and doubtless other genera) agreeing with Alcedininæ (*Alcedo* at least) and the Cerylinæ.

Lacedo (*Carcineutes*) is distinguished by several peculiarities, the strikingly barred upperparts and remarkable difference between the sexes being the most conspicuous. In the proportionate length of the toes *Lacedo* differs from all others of the group and agrees with the typical Ceryline proportions. The second toe (with claw) is a trifle longer than the third and fourth toes (without claw); in other genera the second is shorter than the third and barely or not as long as the fourth.

It is curious that in the barring of the upperparts, the sexual difference in the coloration of the underparts and the relative length of the toes this genus should so strongly recall the Cerylinæ, but the resemblance cannot be considered as anything but a coincidence. The resemblance of the female to *Bucco radiatus*, a bird of another suborder, is quite striking, and in its conspicuous fulvous collar the *Bucco* is even more Kingfisher-like than *Lacedó* itself.

The tuft of the oil-gland is well developed in about half of the genera of Daceloninæ. In *Clytoceyx* and *Monachalcyon* it is rather small and sparse, in *Lacedo* and *Melidora* reduced to a mere vestige and in *Tanysiptera* and *Cittura* it is altogether wanting. The absence of the tuft in *Tanysiptera* has been previously recorded by Beddard and in *Cittura* by Mitchell, and my observations confirm their statements.

The character of the tarsal podotheca is a useful generic character but too variable to use in delimiting the subfamilies. It is constant in the Alcedininæ in all of which the tarsus is covered with skin only, without a suggestion of scales. In the Cerylinæ we find that *Chloroceryle* differs from the two other genera in its unscaled podotheca. In the Daceloninæ it is naked only in *Cittura*, covered with a single row of broad plates as in *Halcyon*, a double row as in *Monachalcyon*, or with three or more rows as in *Dacelo*.

The extent of coherence between the anterior toes is very constant throughout the family, and the form of the external nostrils is of no more than generic value. The nostril is a narrow slit in the Cerylinæ and Alcedininæ, wider and more open in most of the Daceloninæ.

The natural grouping of the genera in the Daceloninæ is a matter of considerable difficulty and no arrangement can be considered final until the internal anatomy has been examined.

It is obvious that *Halcyon* and *Todirhamphus* are very closely related, while *Dacelo*, *Choucalcyon*, and probably *Clytoceyx* form a natural group, but the exact positions of the remaining genera is a question for future determination.

Tanysiptera is highly remarkable in the form of its tail but in no other respect, though the almost perfect agreement of the sexes in coloration is worthy of note. In his 'Map of the Family Alcedinidæ' Sharpe places *Monachalcyon* between *Halcyon* and *Tanysiptera*, a position almost certainly wrong in my opinion. *Monachalcyon fulgidus* recognized by Sharpe in his Monograph as a distinct genus, *Caridonax*, I have not seen. It is apparently much like *Monachalcyon* in form but strikingly different in coloration and closer examination may discover characters of generic value.

The Alcedininæ is a very compact group, the genera all being closely related. They are based on the form of the bill, compressed in some, more or less depressed in others, and in the development of the second toe, which is always short and often vestigial or absent. *Ceycopsis* is a weakly characterized genus being perfectly intermediate between *Ispidina* and *Ceyx*, differing from the former only in the slightly shorter second toe.

PART II. THE GENERA OF CERYLINÆ.

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GENERIC NAMES.

It is rather remarkable that with all the minute generic subdivision of recent years the old genus *Ceryle* has thus far remained intact.

The obvious differences between the Neotropical green Kingfishers, the large crested, blue-gray species found in both hemispheres, and the black and white Afro-Indian *Ceryle rudis* (the type of the genus), were first recognized in nomenclature by Kaup in 1848, when he distinguished the first two mentioned groups as *Chloroceryle* and *Megaceryle* respectively. In the same paper Kaup proposed names for three other groups of Kingfishers, *Ispidina*, *Corythornis* and *Cittura*. All of these names were used subgenerically by Kaup, but while the last three have been universally accepted as genera, most authorities have continued to treat *Megaceryle* and *Chloroceryle* merely as subgenera. These two groups, however, are actually more distinct than either *Ispidina* or *Corythornis* and are distinguished by characters of ample importance to entitle them to the rank of genera. Several of the more important differences are not obvious or do not exist in the museum skin and this fact has retarded the recognition of the distinctness of these groups. Kaup's choice of names for his sections of *Ceryle* was felicitous as both are most appropriate; the dark glossy green of *Chloroceryle* is unique in the family, while the large size of the species of *Megaceryle* distinguishes them from the others of the Ceryline group.

GENERIC SYNONYMY.

In addition to the three valid generic names, four others have been proposed in this group which cannot be used, one of them being preoccupied while the three others are either absolute or virtual synonyms. The complete list of these names follows:

Ceryle Boie, Isis, XXI, 1828, 316. Type by subsequent designation, the first species, *Alcedo rudis* Linn. (Gray, 1840). This species is also the type by elimination (Kaup, 1848). *Ceryle* originally contained five species: *rudis*, *amazona*, *americana*, *alcyon*, and *bicolor* (= *inda*). By the recognition of *Chloroceryle* and *Megaceryle* this genus is restricted to a single species (divisible into three subspecies), characteristic of the Afro-Indian Region.

Chloroceryle Kaup, Verh. naturhist. Vereins Hessen, II, 1848, 68. Type, by subsequent designation, *Alcedo amazona* Latham (Gray, 1855). The first species is *Alcedo superciliosa* Linn. (= *Alcedo aenea* Pallas). By elimination either *amazona* or *americana* could become the type. The original species of this genus were the same four as at present recognized, with the addition of "*bicolor*," a synonym of *inda*. Four very distinct species, with four or five subspecies, all confined to the Neotropical Region. A very natural genus, of which the following is a synonym.

Amazonis Reichenbach, Handb. Alced., 1851, 28. Type, by subsequent designation, the first species, *Alcedo superciliosa* Linn. = *Alcedo aenea* Pallas (Sharpe, Jan. 1871 and 1892). Not *Amazona* Lesson, 1831. This was proposed as a subgeneric term to include *Chloroceryle aenea* and *C. inda* and was used generically for the same two species by Bonaparte. These scarcely differ from *C. americana* except in coloration and in my opinion are not even subgenerically separable from the latter.

These three species collectively, however, differ in several respects from *C.*

amazona (the type of *Chloroceryle*) and the name *Amazonis* might be used subgenerically to express this difference. The utility of subgenera, however, with the small present-day genera is very doubtful. Moreover, *Amazonis* is perhaps invalidated by *Amazona* Lesson, 1831.

Megaceryle KAUP, Verh. naturhist. Vereins Hessen, II, 1848, 68. Type, by subsequent designation, *Alcedo maxima* Pallas (Gray, 1855). The first species is "*guttata*," presumably *guttata* Vigors, 1830 (not of Boddaert, 1783 = *Alcedo maxima* Pallas), *Ceryle guttulata* Stejn. Elimination would fix the type on *guttata* (*guttulata*) for though this was the first species to be removed from the genus (by Reichenbach in 1851), it was not placed in a new genus, but merely transferred back to the old genus *Ceryle*. The original genus contained the same species now referred to it. with the exception of the slightly distinct *lugubris*.

Five species, four of them very strongly marked, and three subspecies, one or two of which may be specifically distinct. The only genus of Kingfishers found in both Hemispheres; generally speaking each of the four great continents is inhabited by a characteristic species. Three other generic names have been used for the various species of this very natural and compact genus, as follows:

Ispida Swainson, Classif. Birds, II, 1837, 336. Type, by subsequent designation, the first species, *Alcedo alcyon* Linn. (Sharpe, Jan. 1871 and 1892), not *Ispida* Brisson, 1760. Contained *alcyon*, *bitorquata* (= *rudis*) *gigantea* (= *maxima*) and *torquata*. This is the earliest name for the genus *Megaceryle* but is invalidated by Brisson's name for those who accept the genera of that author.

Streptoceryle Bonaparte, Consp. Volucr. Anisod., 1854, 10. Type, by subsequent designation, the first species, *Alcedo torquata* Linn. (Gray, 1855; Sharpe, Jan. 1871, and 1892).

This genus was quite unnecessarily established by Bonaparte (as a full genus) for *torquata* and *alcyon*, the New World species of *Megaceryle*. They are both, at least *M. torquata*, strictly congeneric with *M. maxima*.

Ichthynomus Cabanis and Heine, Mus. Hein., Th. ii, 1860, 150. Type, by monotypy, *Alcedo maxima* Pallas.

This is a pure synonym of *Megaceryle*, having the same species as its type. Five years before *Ichthynomus* was published Gray had, in 1855, designated *maxima* as the type of *Megaceryle*, although this is the last mentioned of the four species given by Kaup under that genus. In specifying the *last* species as the type Gray was probably influenced by Reichenbach's ill-advised action (in 1851) in transferring *guttata* (= *guttulata*) from *Megaceryle* back to true *Ceryle*, and by Bonaparte's removal (in 1854) of *torquata* and *alcyon* to his genus *Streptoceryle*, leaving only the single species *maxima* in *Megaceryle*. Possibly also the fact of there being two *guttatas*, that of Boddaert (= *maxima* Pallas) and that of Vigors (= *guttulata* Stejn.) made it seem undesirable to Gray to fix *guttata* as the type.

On the other hand Cabanis and Heine in founding the genus *Ichthynomus* for *M. maxima* took Kaup's *guttata* as the *guttata* of Vigors (*guttulata* Stejn.) in which they were unquestionably correct, and considered it as the type of *Megaceryle* (doubtless because of its being the first species), ignoring Gray's citation of *maxima* as the type of the latter genus.

Unfortunately the nomenclature in this group is still unsettled, for it is uncertain whether it will not be necessary to replace *Alcedo* by *Ispida* and to use the former name in place of *Megaceryle*.

The type of the Linnæan genus *Alcedo* (1758), by subsequent designation, is the first species, *A. ispida* (Lesson 1828, Gray 1840). The type of Brisson's *Ispida* (1760) is, by absolute tautonymy, its first species, *I. ispida.*

If the fact that the types of these two genera are the same renders *Ispida* a synonym of *Alcedo* then *Ispida* is thereby canceled and removed from further consideration, and the changes above mentioned are averted. However, at the time *Ispida* was established *Alcedo* had no type, as this was not fixed until 1828. For this reason some maintain that *Ispida* cannot be canceled but must be used for *Alcedo ispida. Alcedo* would then be tenable for one of the other species of the original genus, and should probably be used either for *A. smyrnensis,* which is a species of *Halcyon* (Swainson, 1820), but is not the type of this or of any other genus, or for *A. alcyon,* a species of *Megaceryle* (Kaup, 1848), and the type of *Ispida* (Swainson, 1837, *nec* Brisson, 1760), by special designation (Sharpe, 1871).

By pure elimination the type of *Alcedo* Linn. is *A. alcyon.*

As there is a decided difference of opinion among the systematists whom I have consulted as to the interpretation of the rules bearing on this case it seems best to leave these names as currently understood, particularly as there is a strong probability that no change will be necessary. The question may well be left for decision by the International Zoölogical Commission.

DIFFERENTIAL CHARACTERS.

In the accompanying tables the differences between the three genera are briefly stated.

Unfortunately the osteology and myology of true *Ceryle* (and, excepting the skull, of *Ch. amazona*) do not seem to have been investigated. When these are known the exact relation of *Ceryle* to *Megaceryle* and *Chloroceryle* will be much clearer than at present.

In external characters, at least, it will be observed that both *Megaceryle* and *Chloroceryle* possess a number of unique characters, while *Ceryle* has fewer strongly marked peculiarities, being mainly characterized by a combination of the characters of the two other genera. In the texture and coloration of its plumage, however, it stands quite alone.

Megaceryle is unquestionably the most strongly characterized genus, as several of its characters (form of crest, extreme shortness of tarsus and hallux, and coloration) are found in no other genus of the family. It is highly probable that several of its skeletal or myological peculiarities are also unique, but some of these may prove to be shared by *Ceryle.*

Of the nine exclusive characters of *Chloroceryle* only four are constant, the five others failing in *C. amazona,* the aberrant member. This species

Table showing the external differences between the three genera.

	MEGACERYLE	CERYLE	CHLOROCERYLE
Form of bill	Stout (moderate in *alcyon*)	*Slender*	Moderate to rather slender
Tomia	*Serrate*	Entire	Entire
Interramal feathering	Normal	*Overlapping rami*	Normal
Crest	Occipital and *vertical, highly developed*	*(Occipital)*	(*Occipital; short and blended* in three species)
Texture of plumage	*Comparatively harsh; lusterless*	*Soft, hairy, satiny*	Soft, *glossy metallic above*
10th primary	> 5 to > 6 (> 7 in *alcyon*)	> 6	$= 3$ to nearly $= 6$
5th secondary	Diastataxic	Diastataxic	*Eutaxic*
Tail, graduated	(*For more than $\frac{1}{15}$ but less than $\frac{1}{8}$ of its length*)	*For less than $\frac{1}{15}$ of its length*	(*For more than $\frac{1}{8}$ of its length* in three species; more than $\frac{1}{15}$ in one species)
Rectrices, tip	Not widened (sometimes narrowed) *somewhat pointed*	*Broadened and obtusely rounded*	Rounded but not widened
Length of tarsus	*Extremely short*	Very short	Short
Length of hallux	*Extremely short*	Rather short	Rather short or moderate
Anterior toes	Short; $2 > 4$, $=$ or > 3 (or a trifle < 3, but rarely so except in *M. maxima*)	Short; $2 > 4$, $=$ or > 3	*Longer;* (*$2 <$ or $= 4$, < 3*, in three species)
Acrotarsium	Scaled	Scaled	*Without scales*
Upperparts, ground color	*Gray, wholly or partly blue-gray*	*Black and white*	*Glossy green*
Markings above, wings and tail	Feathers of upperparts uniform, spotted or barred; *no large white areas on scapulars*, secondaries, or rectrices, no solid white on outer webs of primaries	*Feathers of upperparts black, tipped with white* and with more or less basal white. *Large white areas in scapulars, secondaries, primaries, and all rectrices*	Feathers of upperparts not tipped with white. Inner secondaries with considerable black on inner web near tip; central rectrices without basal white
Underparts	With rufous on chest or belly in at least one sex. *Axillars white in male, rufous in female*	*With no rufous.* Female with one, *male with two black bands on breast*	With rufous on chest in male and sometimes on belly in both sexes. Sexes not differing in color of axillars
Size	(*Large, M. alcyon* medium)	Medium	(*Very small to small* in three species; medium in one)
Geographical distribution	*Both hemispheres*	*Afro-Indian*	*Neotropical*

Table showing the osteological difference between Megaceryle and Chloroceryle.[1]

	MEGACERYLE	CHLOROCERYLE
Post-palatal spine	Vestigial	Slightly longer
Maxillary	Greatly expanded	Less conspicuously expanded
Descending process of lacrymal and pars plana	Meeting at upper edge of former and bounded above by a large vacuity	Meeting below upper edge of former and with a smaller vacuity above
Mesethmoid	Produced anteriorly in a thin triangular plate	Plate smaller
Sternal keel	Very high, anterior edge straight, obliquely ascending	Lower, anterior edge concave
Costal process .	Wider and blunter	Narrower and more pointed
Clavicle	With no process near proximal end (latter broad and blunt); flattened at symphysis	With a conspicuous process near proximal end (latter narrower and more pointed); not flattened at symphysis
Coracoidal foot	With a conspicuous upstanding process on inner side; outer corner obliquely cut off	With no process on inner side; outer corner not obliquely cut off
Iliac process	Conspicuously developed	Slightly less strongly developed
Tarso-metarsus	Extremely short	Moderately short

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[1] These characters are based on *M. alcyon*, *M. torquata*, *Ch. americana*, and (skull only) *Ch. amazona*.

nearly agrees with *Ceryle* in all five of these points and with *Megaceryle* in three or four of them. In the appended table the characters peculiar to each genus are given in italics; those enclosed in parentheses are diagnostic except for *Chloroceryle amazona.*

In all of the above skeletal characters (except outer corner of foot of coracoid and form of costal process) *Megaceryle* is unique in the family as far as known, while *Chloroceryle* is intermediate between *Megaceryle* and the other (non-Ceryline) genera, being nearer *Megaceryle* in most respects, but in the form of the clavicle, sternal keel and coracoid agreeing more closely with the Daceloninæ.

Table showing the myological differences between Megaceryle and Chloroceryle.[1]

	MEGACERYLE	CHLOROCERYLE
Latissimus dorsi anterior et posterior	Subequal	Anterior very thin, posterior enormous
Expansor secundariorum	Present, but feeble	Absent
Ilio-tibialis externus	Belly narrow (*maxima*) or rather narrow (*alcyon*)	Broad
Ilio-tibialis	Preacetabular part well developed	Represented by a band of fasciæ with only a few muscular fibres near proximal end.
Caud-ilio femoralis, pars caudalis	Comparatively narrow	Somewhat wider
Peroneus superficialis	Moderately reduced	Greatly reduced, merely a long tendon.
Deep plantar tendons	Vinculum forked, etc.	Vinculum simple, etc.
Deltoides propatagialis	(*Ch. americana* resembles *Megaceryle*)	(*Ch. inda* differs from *Ch. americana* as well as from *Megaceryle*)
Alar tendons	*Brevis* generalized	*Brevis* specialized

The three smaller species of *Chloroceryle* (particularly *C. inda* and *C. ænea*) approach the other subfamilies in several characters found in no other Cerylinæ. Thus in the relatively short second toe they agree with the Daceloninæ and approach the Alcedininæ; in the more rounded wing they are nearer the Daceloninæ, and in the orange of feet and lower mandible they resemble many members of both those groups.

On the other hand in two skeletal peculiarities (mesethmoid and palatines) *C. americana* agrees with *Megaceryle* while *C. amazona* is distinctly different.

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[1] These characters are taken from Mitchell, and are based wholly upon *M. alcyon, M. maxima, Ch. americana,* and *Ch. inda.*

The following list shows how *Chloroceryle* combines many of the characters of *Megaceryle* (though often to a less degree) with others agreeing better with those of the Alcedininæ or the Daceloninæ or both.

Agreements with Megaceryle.

Markings of remiges and rectrices.
Tibial feathering.
Nostrils (in skull).
Form of pelvis (*Alcedo* not known).
Form of scapula (*Alcedo* not known).

Nearest Megaceryle but showing approach to others.

Primary formula.
Length of third and fourth toes.
Relative length of second toe (*C. amazona* agrees with *Megaceryle*, others with Daceloninæ).
Bill, depth and tomia (depth between *Megaceryle* and Alcedininæ).
General color, no blue (the glossy green perhaps nearer blue of other subfamilies than to gray of *Megaceryle*).
Sexual coloration (agreement with *Megaceryle* in chest color, but no sexual difference elsewhere).
Maxillary (very near *Megaceryle*).
Palatal foramen (*C. americana* like *Megaceryle*, but *C. amazona* apparently like other groups).
Post-palatal spine (*Halcyon* and *Ramphalcyon* not known).
Pars plana and desc. process of lacrymal (between *Megaceryle* and *Alcedo;* Daceloninæ still more different).
Mesethmoid (*C. americana* nearest *Megaceryle; C. amazona* apparently like Daceloninæ).
Quadrate (approaching Alcedininæ).
Iliac process (very different from Daceloninæ).

Nearest Alcedininæ or Daceloninæ or both.

Absence of vertical crest.
Length of tarsus (between *Megaceryle* and Daceloninæ, like *Ramphalcyon*, nearly like Alcedininæ).
Tarsal podotheca (like Alcedininæ).
Foot of coracoid (normal, differing from *Megaceryle*).
Sternal keel (normal, differing from *Megaceryle*).
Process of clavicle (less highly developed, approaching *Megaceryle*).
Symphysis of furcula.

Bill.— The bill in all three genera is straight and compressed. The variations in size and form are as marked within the limits of each of the two larger genera as between any two of them.

As a basis of comparison the distance from the bend of the wing to the tips of the lower primary coverts has been adopted. The following figures show the length of the bill relative to this distance.

Ratio of length of bill to distance from bend of wing to tips of lower primary coverts.

Megaceryle	*alcyon*	1.50
	lugubris *guttulata*	1.44
	torquata	1.15
	maxima	1.14
Ceryle	*rudis* (excluding *C. r. insignis*)	1.15
Chloroceryle	*inda*	1.05
	amazona	.98
	ænea	.98
	americana	.91

The bill is relatively stoutest (deepest compared to its length) in *Megaceryle,* but *M. alcyon* agrees in this respect with *Ch. inda* which has decidedly the stoutest bill of its group. *Ceryle* has a strikingly slender bill, slenderer than that of any other species though closely approached by *Ch. americana,* there being in fact only an average difference between these two species.

The relative depth of the bill is shown by the following statements. The figures indicate the number of millimeters by which four times the depth of the bill at gonydeal angle falls short of or exceeds the length of the bill from the anterior end of the nostril.

In *Ceryle* length of bill from nostril is *more* than four times depth of bill at gonydeal angle (constantly and decidedly, 2–8 mm. more, averaging 4.2 mm.).

In *Megaceryle* length of bill from nostril is *less* than four times the depth at gonydeal angle (1–6 mm. in *alcyon,* av. 2.6; 5–12 mm., av. 7, 9, 11, in three other species).

In *Chloroceryle* the bill averages more slender than in *Megaceryle* and stouter than in *Ceryle.*

Relative thickness of bill.

	Extremes	*Average*
Ceryle	—2. to —8	—4.2
Chloroceryle		
americana	—4. to + .5	—2
amazona	—(5.5) 2.3 to +2	— .6
ænea	—3 to +2.5	+ .8
inda	+1 to 4	+2.8
Megaceryle		
alcyon	(—4) +1 to 6	+ 2.6
maxima	+ 5 to 10	+ 7.
torquata	+ 4 to 10	+ 9.
guttata	+10 to 12	+11.

The variation in the outlines of the bill and in its exact proportions furnish specific rather than generic characters, hardly any two species closely agreeing in the precise form of the bill.

In its serrated tomia *Megaceryle* differs from both the other genera. These serrations are usually distinct in all the species of *Megaceryle*, but in some individuals of *M. alcyon*, *M. lugubris*, and *M. guttulata* they are obsolete.

In *Chloroceryle* the tomia are never distinctly serrate, only an occasional individual showing a very slight approach to this condition.

In *Ceryle* the edges of the mandibles are perfectly smooth.

Crest.— *Megaceryle* differs from both other genera in its highly developed occipital and vertical crest. *Ceryle* and *Chloroceryle amazona* have a moderate occipital crest, but the three other species of the latter genus are practically crestless.

A striking feature of all the species of *Megaceryle* is the long compressed crest. No other genus of Kingfishers has a crest of similar form. It covers the entire pileum from the forehead to the nape, extending forward to the extreme base of the bill. The feathers as far forward as the anterior end of the eyes are conspicuously elongated. Those of the vertex are as long as those of the occiput or even longer in some species. Those between the eyes are longer than half the length of the bill. It is the high development of the feathers of the anterior part of the crown that mainly distinguishes the crest of *Megaceryle* from that of the allied genera which altogether lack a vertical crest. The individual feathers are long, narrowly linear or linear lanceolate, the web not as conspicuously frayed out as in *Ceryle*.

In *Chloroceryle* there is no vertical crest, but in all the species the feathers of the crown are of ample length and breadth. Those of the occiput are decidedly lengthened, rather broad, very soft and blended, and of somewhat hairy texture, forming a short bushy crest. In *Chloroceryle amazona* the crest is more conspicuous, the feathers longer and narrower, yet scarcely linear, more distinct from each other (less blended) and firmer (less hairy). They are broader than in *Megaceryle;* and compared with *Ceryle* are much firmer, less soft, and slightly shorter and broader. In this genus and in *Ceryle* the feathers of the vertex are much less than one-half the length of the bill.

Ceryle has a crest most like that of *Chloroceryle amazona* but the occipital feathers are slightly longer and narrower. They are also very soft and hairy, being conspicuously frayed out along the margins into long delicate fringes.

Interramal feathering.— In *Ceryle* the feathering of the interramal space is peculiar. The long, soft feathers bordering each fork of the mandible curl outwards and upwards, overlapping the ramus and completely hiding its lower sides. In the other genera the feathering is normal, the overlapping being exhibited to only a slight degree at most.

Primary formula.— In the proportionate length of the primaries, aside from the usual individual variations, there are specific differences between certain members of each genus and average differences between the three genera. This amounts to a sharp distinction only between *Ceryle* and *Chloroceryle.*

In *Ceryle* the tenth primary is normally *longer* than the sixth while in *Chloroceryle* it is invariably *shorter* than the sixth.

In *Megaceryle alcyon* the tenth primary is even longer, relatively, than that of *Ceryle,* always decidedly exceeding the sixth; it is always nearer the seventh quill than the sixth and often exceeds the seventh. In the remaining species of *Megaceryle* the tenth primary is always nearer the sixth than the seventh and is always longer than the fifth.

Stated in condensed form the proportionate length of the tenth primary in the various species is as follows:

M. alcyon	always nearer seventh than sixth, often longer than seventh.
Ceryle rudis	longer than sixth, not nearer seventh than sixth.
M. torquata	between fifth and sixth (rarely longer than sixth in *M. torquata,* rarely shorter than fifth in *C. americana* and *C. ænea*).
M. maxima	
M. lugubris	
M. guttulata	
C. amazona	
C. americana	
C. ænea (Mexico)	
C. inda	never longer than fifth.
C. ænea (Honduras southward)	

Fifth secondary. — The presence of the fifth secondary distinguishes *Chloroceryle* from both *Ceryle* and *Megaceryle* in both of which this quill is missing, in other words, the first-named genus is eutaxic or quintocubital while the others are diastataxic or aquintocubital. This character has been determined in all the well marked species of each genus.

Pycraft (1899) gave *M. maxima, M. alcyon, M. torquata* and *C. rudis* as diastataxic and stated that "the remaining species of the genus [*Ceryle,* as currently recognized] are eutaxic." I have carefully examined every species (except *M. lugubris,* which unquestionably agrees in this respect with *M. guttulata*) and my determinations confirm those of Pycraft except as regards *M. guttulata* of which I have examined two specimens and find that it agrees with the other members of *Megaceryle.* Mitchell (1901) records the status of the fifth secondary in *M. maxima, M. alcyon, C. americana,* and *C. inda* and his observations agree with the above.

The exact value of this curious character in the Kingfishers is uncertain because of its variation in *Halcyon,* but in the *Ceryle* group, at least, it coincides with other characters of full generic value.

The majority of large groups of birds (orders or suborders) are consistently either eutaxic or diastataxic, without any exceptions as far as they have been examined. In only three families are both styles of wing known to occur. These are the Columbidæ (Peristeridæ of Sharpe), the Alcedinidæ and the Micropodidæ.

In the Pigeons and Swifts the character always coincides with the limits of currently recognized genera but varies within the subfamilies.

With the recognition of *Megaceryle* and *Chloroceryle* as genera there remains in the Kingfishers only a single genus containing both forms of wing. This is the large and polymorphic *Halcyon* the species of which fall into several minor groups, differing remarkably in the wing formula as well as in the form of the bill and in coloration, and the character of the fifth secondary holds good in each of these sections as far as it has been investigated. As Pycraft remarks: "There is no known exception to the rule that, though a genus may include both forms of wings, it will be found that the species constituting that genus will group themselves, invariably, into two sections, — those with eutaxic and those with diastataxic wings; for, as yet, individual variation in this particular is unknown."

Mitchell, in his paper 'On the Anatomy of the Kingfishers, with Special Reference to the Conditions in the Wing known as Eutaxy and Diastataxy,' uses generically the name *Sauropatis* for the four diastataxic species examined by him.

As *Halcyon* is at present the only genus among birds known to contain both styles of wing there is little doubt that when this character is determined in all the species it will be practicable and desirable to recognize generically one or more of the many names, including *Sauropatis,* currently synonymized under *Halcyon.*

According to Pycraft the Swifts are mostly eutaxic. Of the forms having this type of wing he mentions specifically only one — *Acanthyllis* (= *Chætura* or *Hirundapus*) *caudacuta.* At least two genera, he states, possess both forms, *Dendrochelidon* (= *Hemiprocne*) *mystacea* and *Acanthyllis collaris* (= *Chætura* or *Streptoprocne zonaris*) being diastataxic.

As regards *Chætura,* the large Neotropical fork-tailed Swifts (*Streptoprocne*) are generically separable from the species formerly associated with them.[1]

Whether any of the Tree Swifts (*Hemiprocne*) are eutaxic as stated by

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[1] *Cf.* Oberholser, Proc. Biol. Soc. Washington, XIX, 67.

Pycraft, is doubtful. Of the four more distinct species of the genus I have examined three — *H. longipennis*, *H. comata* and *H. mystacea* — and find them diastataxic.

I can find no published statements in regard to the condition of the fifth secondary in any particular species of *Hemiprocne*. Wray remarks that "the Swifts are quinto-cubital," while Sclater states more definitely that "In true *Cypselus*, as stated by Wray, the fifth *c. r.* is present, as it is also in the Tree Swift (*Dendrochelidon*). But I find it absent in a specimen of *Collocalia*, which is certainly a member of this family."

It may be inferred that Sclater based his remarks on his own examination of some species of the genera and if this was *H. coronota* his statement may prove to be correct as regards this one species. As the matter stands, however, there is need of a careful examination of the latter, and it is probable that it will turn out to be diastataxic like its congeners.

Length of tail.— No generic characters are furnished by the length of the tail. *Megaceryle alcyon* has the shortest tail of the group and *Chloroceryle americana* the longest, but the other species are variously intermediate and perfectly connect them. The difference between the extremes is not great, amounting to only one-third of the distance from the bend of the wing to the tips of the lower primary coverts. In each of the two larger genera the range of variation is almost as great as in all three genera combined. The tail averages longer in *Chloroceryle* than in *Megaceryle* but as shown by the figures the two genera widely overlap.

Ceryle agrees exactly in this character with *Ch. amazona*, the shortest tailed species of its genus, and these fall between the two longer and the two shorter tailed species of *Megaceryle*.

The following table shows the relative length of the tail in the various species. The figures were obtained by dividing the actual length of the tail by the distance from bend of wing to tip of longest lower primary covert.

Distance from bend of wing to tip of longest of several outer lower primary coverts relative to length of tail.

		Ratio			*Ratio*
Ceryle rudis		1.40	*Chloroceryle*		
Megaceryle				*amazona*	1.40
	alcyon	1.33		*ænea*	1.44
	maxima	1.37		*inda*	1.59
	guttulata *lugubris*	1.47		*americana*	1.66
	torquata	1.54			

There is a noticeable variation in the relative length of the central pair of rectrices and those on each side of it. In *Chloroceryle* the median pair is nearly always distinctly (often decidedly) shorter than the longest feathers; in *Megaceryle* this is less frequently the case.

In the Kingfishers, at least in this particular group, there seems to be less uniformity in the relative length of the rectrices than in most birds; often one or two quills will be longer or shorter than they should be. Furthermore, the proportion of specimens with one or more growing rectrices is unusually large.

Form of rectrices.— In the form of the rectrices there are slight but noticeable differences.

In *Ceryle* they are wider terminally and more broadly rounded at the tip than in the other genera.

In *Megaceryle* they are not obviously widened terminally nor broadly rounded at the tip but rather (especially in *M. alcyon* and *M. torquata*) are somewhat pointed, particularly the middle pair. In the latter two species the rectrices are probably slightly narrower than in the three other species of *Megaceryle.*

In *Chloroceryle* the ends of the rectrices are rounded, but are relatively narrower than in *Ceryle,* particularly the short outermost feathers.

Graduation of tail.— The differences in the graduation of the rectrices are more pronounced than those in the length of the tail, but the variations in each respect are, to a large extent, correlated.

As shown in the accompanying table the outer rectrices in *Megaceryle* and particularly in *Ceryle* are only slightly shorter than the longest ones, while in *Chloroceryle,* with the exception of *C. amazona,* the shortening of the lateral quills is much more pronounced.

In *Ceryle* the average amount of graduation amounts to less than one-fifteenth of the length of the tail. In *Megaceryle* and in *Chloroceryle amazona* it is more than one-fifteenth but less than one-eighth, while in *Chloroceryle* (excepting *C. amazona*) the graduation exceeds one-eighth.

The following figures express the proportions borne by the total length of the tail to the distance between the tips of the outermost pair of rectrices and the longest pair.

C. americana	5.0	*M. lugubris*	12.3
C. inda	5.1	*M. guttulata*	
C. ænea	6.0	*M. alcyon*	12.8
C. amazona	13.4	*M. maxima*	14.3
M. torquata	9.6	*C. rudis*	16.2

Feet (general).— The characters of the feet are considered in detail under the following separate heading: Feathering of Tibia, Podotheca, Length of Tarsus, Length of Hallux, Relative Length of Fore Toes.

Some general comparisons may first be made. The group as a whole is distinguished for the bare tibia and short tarsus.

Megaceryle is unique in the family in its small feet, with extremely short tarsus and hallux in particular. In the Cerylinæ the inner anterior toe averages relatively longer compared with the third and fourth toes, and in *Megaceryle* this becomes a constant difference, distinguishing this genus from all other non-Ceryline Kingfishers with the exception of *Lacedo* (*Carcineutes*). The characters of the feet are remarkably similar in the four species of the genus.

Chloroceryle and *Ceryle* differ from each other in the nature of the podotheca; and in the proportions of the toes *Ceryle*, *Megaceryle*, and *Chloroceryle amazona* agree with each other and differ from the three smaller species of *Chloroceryle*.

Feathering of the tibia.— The Cerylinæ differ from all other Kingfishers (though closely approached by two or three of the other piscivorous genera) in the completely bare lower end of the tibia-tarsus. Between the three genera of Cerylinæ there is no constant nor even distinct average difference in this respect. The tibia is not feathered to the joint on any side and is always conspicuously bare in front. The unfeathered space at its most restricted point is always equal to or greater than the lower (short) chord of the claw of the hallux except in some specimens of *Chloroceryle ænea* where the tiny feathers slightly encroach on this space.

Tarsus and toe-covering.— The lower part of the tarsus and upper side of the toes are covered with scales in *Ceryle* and *Megaceryle*, with skin only in *Chloroceryle*.

In *Ceryle* the scales are perhaps not so strongly marked as in *Megaceryle*, at least in occasional specimens of *C. rudis* there are no distinct scales visible. However, in such individuals, the lower end of the tarsus is always covered with the thicker, hardened outer skin of which the scales are formed. This is wholly absent in *Chloroceryle* in which the entire tarsus is longitudinally wrinkled, as is the upper end in *Ceryle*. Mr. L. A. Fuertes tells me that the feet of *Chloroceryle amazona*, in the bird in flesh, are peculiar and striking, covered with *smooth*, unwrinkled, *intensely* black skin as though a black kid glove were drawn tightly over the foot.

Length of tarsus.— In its exceedingly short tarsus *Megaceryle* differs not only from the related genera but from all other members of the family.

The relative length of the tarsus was determined by comparison with the length of the claw of the hind toe.

In all four species of *Megaceryle* the tarsus is almost exactly 1½ times the length of the long chord of the hind claw, always decidedly less than 1¾ this distance.

In *Chloroceryle* and *Ceryle* the tarsus is 1¾ to very nearly twice the length of the claw. In *Ceryle*, however, the tarsus is relatively slightly shorter than in *Chloroceryle*, as it is decidedly shorter, absolutely, than in *C. amazona* (which does not greatly exceed *Ceryle* in size) and of nearly the same length as in *C. inda* (a considerably smaller bird).

Measured in the skeleton, the tarsus (tarso-metatarsus) of a specimen of *Megaceryle torquata* is 12.6 mm. long, while the femur is 33.4, or much more than twice the length of the tarsus. In an example of *Chloroceryle americana* the tarsus is 9.3, the femur 17.5, or slightly less than twice the length of the tarsus.

In several species of the three genera the metatarsal bone measures as follows:

	mm.
Megaceryle torquata	12.6
" *alcyon*	10.
Ceryle r. leucomelanura	9.7
Chloroceryle amazona	12.
" *americana*	9.3

Megaceryle alcyon and *Chloroceryle amazona* are birds of equal size, *Ceryle r. leucomelanura* being distinctly smaller than either.

These figures confirm the results obtained from skin measurements, *Chloroceryle* having a considerably longer metatarsus than *Megaceryle* while that of *Ceryle* is intermediate.

Comparison of the length of the tarsus with that of the inner toe (without claw) is not altogether satisfactory because of the variation in the relative length of the latter.

In all the species of *Megaceryle* the tarsus is distinctly shorter than the inner toe, fully one millimeter shorter in *alcyon* and *torquata*.

In *Ceryle* the tarsus about equals the inner toe.

In *Chloroceryle* there is more variation than in *Megaceryle*, ranging from *C. amazona*, in which the tarsus is always distinctly shorter than the inner toe, to *C. aenea* in which it is equal to or sometimes slightly longer than the inner toe.

Length of hallux.—The length of the hallux is correlated with that of the tarsus, consequently it is relatively shorter in *Megaceryle* than in the two other genera.

Ceryle rudis, though a decidedly smaller bird than *Megaceryle alcyon*, has an actually slightly longer hallux, while in *Chloroceryle amazona*, which is practically identical in size with *alcyon*, the hind toe is decidedly longer than in the latter.

In *Megaceryle* the hallux with its claw is not so long as the inner toe exclusive of the claw. In *Chloroceryle* these measurements are equal or the hallux is a trifle longer than the inner toe.

Comparing the upper or long chord of the claw of the hind toe with the length of the toe itself (the latter measured either along its upper side or along the outer side from the seam crossing its base to the end, above) we get the following results: In *Megaceryle* the hallux is distinctly to decidedly shorter than its claw; in *Ceryle* and *Chloroceryle* the hallux is decidedly to barely longer than the claw. This is most pronounced in *C. inda,* and perhaps in *C. ænea.*

On comparison of *Ceryle rudis, Chloroceryle amazona* and *Megaceryle alcyon* the following points of interest in the proportions of the tarsus and toes may be remarked.

Relatively speaking, *alcyon* has the shortest tarsus and hallux. *M. alcyon* and *Ceryle* have very short fore toes, *amazona* distinctly longer.

Ceryle has the anterior toes, and, to a less extent, the tarsus (and hallux) relatively shorter than in *amazona.*

These general proportions hold good for all species of the three genera. The characters of each genus may be summarized as follows:

Megaceryle. Feet stout; tarsus and hallux extremely short, anterior toes short.

Ceryle. Feet slender; tarsus very short, toes short.

Chloroceryle. Feet slender; tarsus short, toes (third and fourth at least) moderate or fairly long.

Anterior toes.— The proportionate length of the anterior toes (the second compared with the third and fourth) distinguishes *Megaceryle* and *Ceryle* from all the non-Ceryline Kingfishers excepting the genus *Lacedo* (*Carcineutes*). *Chloroceryle* is intermediate between *Megaceryle* and the remaining genera of the family, but *C. amazona* practically agrees with *Megaceryle.*

In *Megaceryle* the claw of the second toe invariably reaches beyond the base of the claw of the fourth toe (in eighteen specimens of *alcyon* and eight of *lugubris* and *guttulata* there is no exception to this statement; in fifteen of *torquata* there is a single exception, and one foot of one of the five specimens of *maxima* examined also violates the rule).

In *Ceryle* the proportions of the second and fourth toes are the same as in *Megaceryle,* only two of fifteen specimens varying from this standard, and in each of these in one foot only. The same relative length is found in *Chloroceryle amazona,* only one bird in the ten examined being aberrant. In the three other species of *Chloroceryle* the second toe is relatively shorter. In *C. americana* (fourteen skins) as a rule, the claw of the second toe just reaches the base of that of the fourth toe, sometimes slightly exceeding this and sometimes falling a trifle short. *C. inda* (six skins) and *C. ænea* (nine skins) agree practically with *C. americana*, but the second toe averages perceptibly shorter, its claw rarely passing beyond the base of that of the fourth toe, but equalling or falling a trifle short of it.

The genus *Lacedo* agrees with *Megaceryle* in this respect but in no other Old World genus of Kingfishers does the claw of the second toe pass beyond the base of the claw of the fourth toe.

Comparing the second and third toes we find much the same proportions exhibited. In *Megaceryle* (except *M. maxima*) and in *Ceryle* the second toe with claw almost always equals or slightly exceeds the third toe without claw. In *M. maxima* it is more often a trifle less than the third, than a trifle more, and *C. amazona* agrees with *M. maxima* in this respect.

In the three other species of *Chloroceryle* the claw of the second toe falls short of the base of the third toe-claw, though sometimes only very slightly so in *C. americana*. In all non-Ceryline genera except *Lacedo* the claw of the second toe falls short of the base of the claw of the third toe. In *Lacedo* it slightly passes this point.

Thus, broadly speaking, *Megaceryle*, *Ceryle*, and *Chloroceryle amazona*, on the one hand, agree in the proportionate length of the anterior toes, while on the other hand, the three smaller species of *Chloroceryle* essentially agree with each other. These two groups, however, are practically connected by the more or less intermediate species, *M. maxima*, *C. amazona*, and *C. americana*.

Coloration.— While a particular style of coloration characterizes each of the genera of Cerylinæ, color characters of greater importance distinguish the entire group from the Alcedininæ and Halcyoninæ.

The Cerylinæ entirely lack the changeable blue or greenish blue so characteristic of the other subfamilies, being found in every genus, if not, indeed, in every species of those groups.

The entire upperparts, including the head, wings and tail are of one color or pattern throughout (except for a white or ochraceous collar) frequently variegated on the body plumage and always on the remiges and rectrices with white or buff (and sometimes with black), in small pattern, or often, on the wings and tail, in large areas. The sexes never differ in the color of the head or tail as is so frequently the case in the Daceloninæ. The sexual difference in the color of the underparts, particularly in the banding of the chest, is found throughout the Cerylinæ and is very characteristic of the group. A chest-band is always present, though in the three species in which the male (at least) is rufous-bellied, the rufous of the chest-band is continuous with the rufous of the abdomen. The female always has a conspicuous chest-band of the same color as the upperparts, *i. e.*, of a non-

in being broad and rounded terminally instead of tri-
pointed. Fürbringer states that in this genus the procoracoid
with the acrocoracoid by a bony bridge. This peculiarity is
confined to the present subfamily.
of the sternum show that the keel is high and prominent
as in *Megaceryle* (more as in *Chloroceryle*), the upper or anterior
ly concave as in all the genera examined except *Megaceryle*.
(at least 12 genera).— Restricted to the Old World and,
exception of the large and widely distributed genus *Halcyon*,
Australian and Indian Regions. Only two other genera (*Ram-*
and *Lacedo*) are found at all outside of the Australian Region and
mostly confined to the Indo-Malayan subregion. *Lacedo* is the
the group not represented in the Australian Region.
small to very large, the smallest species about equalling the
of the Alcedininæ.
ly variable in length and general shape, varying from long
and from very deep to much depressed, but compressed only
In all the others except *Halcyon* the form of the bill is
that found in the other subfamilies and in some,
is remarkably modified.
always more or less lengthened, though slightly
ny *Halcyons*. Often, as in *Dacelo*, *Melidora*,
the feathers of both the occiput and vertex
d form a wide flat crest, quite different from
æ. There is nothing approaching the high,
Megaceryle, nor the peculiar form found in
usually broad and rounded at the tip.
edly rounded. In some species of *Halcyon*
the ninth, these two quills being the longest,
ermost quill is shorter than the fifth, usually
than the fourth in all but *Todirhamphus* and

ore, of *Halcyon* the Daceloninæ differ in this
e and from the Cerylinæ except certain spe-

ary formula in *Halcyon* is most remarkbale.
e species much shorter than the first, while
are equal and longest. There are doubtless
ds in which this range of variation is equalled.
r, that this large genus of over eighty forms,
amily, is divisible into at least two genera, as it

of parallel development or convergence. Only one other species of Alcedininæ appears to have a banded chest. This is *Alcedo beryllina* in which the underparts are white with a blue chest-band in both sexes.

In all the species of *Alcedo* there is a curious difference in the color of the bill according to the sex. This is wholly black in the males while in the females more or less of the proximal half of the lower mandible is red.

The tuft of the oil-gland is always well developed. The status of the fifth secondary has been recorded only in *Alcedo* (2 species) and *Ceyx*. These are both eutaxic, and in all probability the other genera are the same.

Of miscellaneous characters may be mentioned the color of the bill, which is often entirely red; the tomia are always smooth, and the tip of the maxilla is never hooked. The loral feathering is normal and the rectrices always number twelve.

The osteological characters are presumably rather uniform throughout the group, but unfortunately I have had for examination only the skull of *Alcedo ispida*, and the following notes are based on this species.

The culmen is not depressed back of the nostrils and the latter are longer and extend further back than in the Cerylinæ, agreeing better with the Daceloninæ. The mesethmoid projects somewhat anteriorly, most resembling the Cerylinæ in this feature. The pars plana of the mesethmoid meets the descending process of the lacrymal a trifle above the middle, being thus intermediate between the Cerylinæ on one hand and *Dacelo* and *Halcyon* on the other. The lacrymal is shorter than that of the Cerylinæ but agrees in its truncate posterior margin, and is not at all produced backwards as in *Dacelo* and *Ramphalcyon*.

The maxillary is not conspicuously expanded, agreeing with the Daceloninæ and differing from the Cerylinæ. The posterior palatal spine is long and slender, much like that of Dacelo but even longer and very different from that of *Chloroceryle* and *Megaceryle*. (In the skulls of *Ramphalcyon* and *Halcyon* examined the palatines are imperfect and this character cannot be determined.) (Plate XXV, Fig. 1.)

The orbital process of the quadrate is remarkably short and blunt. This condition is very different from that found in most genera, but is doubtless most closely related to that seen in *Chloroceryle* (in *C. americana* more than in *C. amazona*) in which the orbital process is a very slender spine. The disappearance of this spine would result in a quadrate much like that of *Alcedo*.

As no part of the body skeleton has been available for examination, I am unable to describe the sternum, shoulder girdle or pelvis in detail. Fürbringer's figures, however, show that there is a process near the proximal end of the clavicle as in *Halcyon, Dacelo,* etc., but even larger and more preacetabular portion of this muscle is well developed. In *C. americana* and *C. inda* "the muscle is represented by a band of fasciæ with only a few muscular fibres near the proximal end" (*l. c.*, p. 113).

Caud-ilio-femoralis.— The *pars caudalis* is comparatively narrow in *Megaceryle alcyon* and *M. maxima*, somewhat wider in *C. americana* and *C. inda.*

Peroneus superficialis.— This muscle is in a degenerate state in birds. "In *Dacelo* it arises from the external corner of the tibial crest as a narrow tendon, instead of the more normal broad origin by muscle or fasciæ. It is joined by a few fibres from the tibia along the region of the fibula, and is inserted to the knee-capsule without the usual slip to the flexor of the middle digit. The same condition exists in all the diastataxic forms and in some of the eutaxic forms. But in other eutaxic forms, notably *Ceryle americana* and *C. inda,* in the *Halcyones,* and *Ceyx* it is still more reduced, being simply a long round tendon with the merest vestige of muscular fibres in it" (*l. c.*, p. 116).

Deep plantar tendons.— A well marked difference in these tendons between *Megaceryle* and *Chloroceryle* is clearly shown in the figures given by Mitchell of the four species examined by him.

"The typical Kingfisher condition, that most strikingly different from those more common in other birds, is for the so-called *hallucis* to supply digits three and four, and for the so-called *communis* to supply the hallux and digit two. This is extremely well seen in the eutaxic forms; only a narrow vinculum connects the two tendons. In *Dacelo* and *Sauropatis* and especially in the diastataxic as contrasted with the eutaxic *Ceryles,* the communis retains a more strong hold on the third and fourth digits by means of a branching vinculum, so that in these Kingfishers the peculiarity is not so acutely marked" (*l. c.*, p. 119).

In other words, in *Chloroceryle* a simple vinculum is sent off from well above the bifurcation of the communis and joins the hallucis just above the point at which the latter branches; while in *Megaceryle* the vinculum springs from about the point at which the communis forks and divides into two branches each of which runs to one branch of the hallucis joining it far below the point of forking.

Judging by the figures, *Chloroceryle* agrees in the simple vinculum with *Cittura, Halcyon* (*pileata* and *rufa*), *Ceyx* (*rufidorsa*), and *Alcedo.* In these genera, however, the vinculum springs from about the point at which the communis forks (as in *Megaceryle*) or from below the fork, while in *Chloroceryle* it leaves the communis decidedly above the fork.

Deltoides propatagialis.— In this muscle the differences do not coincide with the limits of the genera, for *C. americana* agrees in general with the two species of *Megaceryle* while *C. inda* is quite distinct, and more closely resembles *Cittura* and *Alcedo.*

Alar tendons.— *M. maxima* and *M. alcyon* agree in the general form of the brevis tendon while *C. americana* and *C. inda* are markedly different from them and at the same time essentially similar to each other.

In the former there is "a broad diffuse band of fasciæ stretching from the deltoides to the extensor muscles, and receiving the pectoralis tendon," the tendons being blended proximally in this band.

In *C. americana* and *C. inda* there is a single rounded tendon proximally, without fasciæ, and one of the tendinal branches well developed in the species of *Megaceryle* is absent in *C. inda* and very small in *C. americana.* These differences are also well shown in Mitchell's plates.

Osteology.— As no skeleton of *Ceryle rudis* could be obtained it is only possible to contrast the osteology of *Megaceryle* with that of *Chloroceryle.* The material available for this comparison consists of one skeleton of *M. torquata,* one, and part of another, of *M. alcyon,* one of *Ch. americana* and an imperfect skull of *Ch. amazona.*

Owing to the somewhat intermediate nature of *Ch. amazona,* judging by its external characters, it is much to be regretted that the sternum and shoulder girdle of this species were not available. Furthermore, the exact relation to the two allied genera of the somewhat ambiguous genus *Ceryle* cannot be determined until its osteology has been examined.

In the following notes the more important skeletal differences between *Megaceryle* and *Chloroceryle* are pointed out. These differences are probably found in all the species of the two genera with the exception, perhaps, of *C. amazona* in which it is possible that the important characters of the sternum and shoulder girdle may show an approach to *Megaceryle.* Most of the distinctions have already been pointed out by Shufeldt in his papers on the 'Osteology of *Ceryle alcyon,*'[1] and 'On the Osteology and Systematic Position of the Kingfishers (Halcyones)'[2], in which he compares *M. alcyon* with *C. americana cabanisi* and *Alcedo ispida.*

Skull.— The palatal foramina are larger in *C. americana* than in *Megaceryle,* but absent in *C. amazona,* the latter thus agreeing with *Alcedo, Dacelo,* and most other Kingfishers.

The posterior palatal spine, so conspicuous in *Alcedo* and *Dacelo,* is vestigial in *Megaceryle* but somewhat better marked in *C. americana.* The outline of the outer edge of the palatines of *C. americana* closely agrees with that of *Alcedo ispida.*

Megaceryle and *Chloroceryle* differ from most if not all other Kingfishers

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[1] Journal of Anatomy, Vol. XVIII, 1884, p. 279.

[2] American Naturalist, Vol. XXXVII, 1903, 697.

(with the probable exception of *Ceryle*) in the abrupt and conspicuous widening of the maxillary or anterior portion of the jugal bar. Thus in *M. alcyon* this is expanded horizontally in a flat, thin plate of bone, 4.5 mm. wide at its broadest part.

In *Megaceryle* the widening begins rather abruptly at a point opposite the anterior end of the pterygoids, involving fully the anterior half of the jugal bar. In *Chloroceryle* the widened portion of the maxillary does not run back so far as in *Megaceryle,* and in *C. amazona,* with a skull equaling that of *M. alcyon* in size, the actual width of the expanded part is slightly less than in that species. (Plate XXV, fig. 1.)

The posterior end of the ramus of the mandible seen from the rear is much thicker and clumsier in *M. torquata* than in *C. amazona* and *C. americana; M. alcyon* is intermediate.

There is a distinct difference in the form of the temporal fossæ between the two genera. In *Megaceryle* the anterior line of the fossa runs slightly forward as it approaches the median line, while in *Chloroceryle* this is not the case. In *Megaceryle* the descending process of the lacrymal is not so high as in *Chloroceryle,* leaving a large transversely oval or elliptical vacuity above it, and is joined by the pars plana of the mesethmoid at its upper inner corner. In *Chloroceryle,* particularly in *C. americana,* the vacuity is decidedly smaller and the pars plana meets it below the upper edge. (In *Alcedo, Halcyon,* and *Dacelo* the superior vacuity is very small; in the former the pars plana reaches the lacrymal almost in its middle and in the latter two genera considerably below the middle, showing the widest divergence from *Megaceryle.*)

In *Megaceryle* the mesethmoid is produced forwards in a pointed plate, vestigial in *Chloroceryle americana,* and wanting in at least *Alcedo, Dacelo* and *Halcyon.* At the base of the maxilla there is on each side a conspicuous impression or hollow both in *Megaceryle* and in *Ch. amazona* but this is almost wanting in *Ch. americana.*

Sternum and shoulder girdle.— In *Megaceryle* the anterior end of the sternal keel is very high and prominent (somewhat as in a Gannet or Merganser), the anterior edge, between the spina sterni and the point of the keel, being an approximately straight ascending line.

In *Chloroceryle americana* the anterior point of the keel is lower and less pronounced, and the edge is concave. This is the case also in *Halcyon, Dacelo,* and *Ramphalcyon* (sternum of *Alcedo* not seen).

The costal processes are relatively shorter, wider and blunter in *Megaceryle* and the exotic genera examined, longer, narrower and more pointed in *Chloroceryle americana.* In the former they are somewhat Passerine, in the latter more as in the Pici. The two genera agree (to a large extent at least) in having shorter and broader furcula, more curved on a side view. There is, however, an important difference between these genera in the form of the furcula. In *Megaceryle* the proximal end is broad and blunt, in *Chloroceryle americana* it is narrower and more pointed. Furthermore, in the latter genus, the clavicle bears near its upper or proximal end a conspicuous upward process that articulates with the front upper end of the coracoid. In *Megaceryle* there is a slight angle at this point but no process. This process is even more highly developed in *Halcyon, Ramphalcyon, Dacelo,* and *Alcedo* than in *Chloroceryle,* being longer and rising more abruptly. The absence of this process is probably therefore peculiar to *Megaceryle,* unless *Ceryle* also prove to be without it.

The widening of the clavicles toward the upper end is much more pronounced in *Megaceryle* and *Chloroceryle* than in other genera. They are also broadened and flattened at their symphysis in *Megaceryle* but not in *Chloroceryle americana* nor in other genera. In *Megaceryle* the coracoid bears a remarkable and conspicuous upward process, springing from the inner edge of its foot. This is wholly absent in *Chloroceryle americana* as well as in all other genera examined, and its presence in *Megaceryle* was overlooked by Shufeldt. In *M. torquata* the projection is 3.5 mm. long, and about equally well developed in *M. alcyon.* (Plate XXVI, fig. 1.)

The opposite or outer end of the coracoidal foot also presents a decided difference. In *Megaceryle* the corner is obliquely cut off, which is not at all the case in *Chloroceryle americana* nor in *Halcyon concretus,* but *H. chloris* and *Ramphalcyon* resemble *Megaceryle.*

No important characters are presented by the scapula but it is observable that in *Megaceryle* the basal or proximal portion is somewhat wider relatively than in *Chloroceryle,* the distal end less conspicuously bent outward and the angle at the bend sharper.

Pelvis.— The process on the outer margin of the ilium characteristic of the Ceryline Kingfishers is somewhat smaller in *Chloroceryle* than in *Megaceryle,* thus reaching its highest development in the latter genus.

Feet.— The remarkable shortness of the "tarsus" in *Megaceryle* is very obvious in the skeleton. Thus in *M. alcyon* the metatarsus (measured along front of inner side) is 10 mm., much less than one-half the femur which is 25.9; while in *C. americana* the metatarsus is 9.2, or distinctly more than one-half the length of the femur, which measures 17.4. Though so little longer than that of *C. americana* the metatarsal bone of *M. alcyon* is much stouter, particularly at its lower end, across which it measures 4.5 mm., against 2.8 in *C. americana.*

I can find no character in the wing-bones worthy of note.

Basing our comparisons only on the genera examined, it is obvious that:

Megaceryle stands quite alone in certain skeletal characters, and in certain others is connected by *Chloroceryle* with the other genera. The most remarkable characters of *Megaceryle* are the vestigial palatal spine, the expanded maxillary, the relation of pars plana and lacrymal, the sternal keel, form of furcula (two differences), form of coracoids, and shortness of metatarsus. In all of these there is a wide difference between *Megaceryle* on the one hand, and *Dacelo*, *Alcedo* (skull), *Halcyon* (palatines ?), *Ramphalcyon* (palatines ?), on the other. In all these characters except the form of the coracoid, symphysis of furcula, and perhaps the sternal keel, and to a large extent of the form of proximal ends of the furcula, *Chloroceryle* strongly approaches *Megaceryle* and differs from the other genera mentioned. The iliac process is peculiar to *Megaceryle* and *Chloroceryle* but is slightly better developed in the former.

It is a curious fact that the geographical ranges of the species of *Chloroceryle* are almost identical, all four of them being found together throughout the greater part of Central and South America. This fact doubtless explains the striking differences in size, the species having become adapted for prey of different sizes. The species of *Megaceryle* are much more uniform in size and their ranges are strictly complementary. It is noteworthy that the genus *Chloroceryle* is absent from the Antillean subregion.

In the succeeding pages the various divisions of the Cerylinæ are treated in detail. Under each genus and species a short diagnosis, including only the characters peculiar to the group in question, is first presented. Following this is a longer and more detailed description.

The genera and species of this subfamily fall naturally in the following sequence.

Megaceryle lugubris
" guttulata
" maxima
" torquata
" alcyon

Ceryle rudis
Chloroceryle amazona
" americana
" inda
" ænea

The only uncertainty in this arrangement is in regard to the relative position of the last two species, as in some respects *C. ænea* approaches *C. americana* more closely than does *C. inda*.

Genus **Megaceryle**.

Large and rather large Ceryline Kingfishers (the wing over 145 mm. long), with finely serrate bill, conspicuous vertical and occipital crest, and extremely short tarsus and hallux; the upperparts wholly or partly bluish gray (without green), the axillars white in the male, rufous in the female.

Large or (one species) rather large Ceryline Kingfishers of both Hemispheres, with wing more than 145 mm. in length, stout, deep bill (moderate in one species) with serrate maxillary tomia (sometimes obsolete in one species), conspicuous vertical and occipital crest, the tenth primary always longer than the fifth, diastataxic secondaries, nearly even tail (the outermost pair of rectrices falling short of the longest by between one-eighth and one-fifteenth of the length of the tail (the central pair not shortened), the rectrices more or less pointed at the tip, the front of the tarsus with distinct scales, extremely short but stout tarsus and hallux, the second toe with claw usually equal to or longer than the third toe without claw (often shorter in one species) and always normally longer than the fourth toe without claw; the plumage lustreless, above solid bluish gray, or slate-gray edged with bluish gray (either plain or varied with spots or bars of white), the scapulars not extensively white basally, and no large white areas on the tail nor across both webs of the primaries, more or less rufous on the underparts in at least one sex, the axillars always white in the male, rufous in the female.

Bill.— According to the size and form of the bill the species fall into three groups. *Maxima* and *torquata* agree in having a large stout bill, much longer than the head; the up-curve of the gonys more prominent than the down-curve of the culmen which is nearly straight; that of *alcyon* is much smaller, being shorter and relatively more slender, the curves of culmen and gonys about equal.

In *lugubris* and *guttulata* the bill is short as in *alcyon* (about equalling the head) but much stouter, even more so, for its length, than that of *maxima* and *torquata;* the maxilla is more decurved, while the gonys is straighter, and the tip of the maxilla is thicker and less attenuated than in the other species. Furthermore, the tomial serrations which are always evident in the long-billed species are often less decided in *lugubris* and *guttulata* and frequently indistinct or obsolete in *alcyon.*

In the following table the figures in the first column indicate the relative length of the bill compared with the distance from the bend of the wing to the tips of the lower primary coverts. Those in the second and third columns give the extremes and the average respectively of the relative depth of the bill, the figures expressing the number of millimeters by which four times the depth of the bill at the gonydeal angle exceeds the length of the bill from the anterior end of the nostril.

	Relative length	*Relative Depth*	
alcyon	1.50	1–6	2.6
lugubris *guttulata*	1.44	10–12	11.
torquata	1.15	4–10	9.
maxima	1.14	5–10	7.

In a single specimen of *alcyon*, which has a long and oddly slender bill, four times its depth is 4 mm. *less* than the length instead of from 1–6 mm. *more* as in all the other specimens examined. The measurements given for *torquata* are of the typical form; *M. t. stellata* has a shorter and relatively deeper bill, but lack of good adult specimens prevents me from giving the bill proportions of this race.

Crest.— The essential character of the crest in *Megaceryle*, as compared with other genera, is the high development of the anterior part or vertical crest, and this is well shown in all the species.

In *M. lugubris* and *M. guttulata* the frontal crest feathers attain their greatest development both absolutely and compared with those of the occiput (especially as contrasted with *M. torquata*). They are more elongated anteriorly than in *M. maxima*, particularly in *lugubris*. The crest is composed of narrow, linear, *broad-tipped* feathers (their ends truncate or very broadly rounded), the webs of which are moderately firm, not conspicuously frayed as in *Ceryle*.

In *M. maxima* the crest is similar to that of *M. lugubris* in development and form of the feathers but is not quite so long (at least relatively), particularly the vertical feathers. The latter are *strikingly elongated* forward to the anterior end of the eye.

In *M. torquata* the crest is not so highly developed as in the other species, the feathers shorter, less linear, distinctly narrowed towards the tip, and more or less pointed.

M. alcyon has a very well developed crest; the feathers relatively longer than those of *M. torquata*, but narrowed terminally and pointed as in the latter, and somewhat more hair-like than in any of the other species, owing to the extensive separation of the barbs. The crest is distinctly double, there being a point about midway between the front and the rear where the feathers are shorter than elsewhere. The crest of this species does not at all approach that of either *Ceryle* or *Chloroceryle*.

The feathering of the lores is correlated with the development of the crest. The loreal feathers are largest and densest, least reduced and appressed, in *M. maxima*, and particularly in *M. lugubris*, and are well developed in *M. alcyon;* in *M. torquata* they are smaller and more appressed than in any other species of the genus.

Wing.— *M. alcyon* is aberrant in its long-pointed wing, the tenth primary always nearer the seventh than the sixth and often exceeding the seventh. In none of the other species is the tenth primary longer than the sixth (except in occasional specimens of *torquata*), and it is normally shorter than the sixth, always exceeding the fifth, however. The proportionate length of the primaries is shown by the following:

alcyon (25 specimens), P. 10 always nearer 7 than 6, often > 7.
torquata (14 specimens), P. 10 decidedly > 6 to decidedly < 6 (usually = or < 6; always nearer 6 than 7, sometimes nearer 5 than 6).
lugubris and **guttulata** (7 specimens), P. 10 decidedly < 6 (from nearer 5 to much nearer 6, always > 5).
maxima (4 specimens), P. 10 < 6 (nearer 6 than 5 in three specimens; always > 5).

Tail.— *M. alcyon* has the shortest tail of the genus and *M. torquata* the longest, but even between these extremes the difference is slight and unimportant. The proportion that the tail bears to the distance from the bend of the wing to the tips of the several outer lower primary coverts is as follows:

alcyon	1.33
maxima	1.37
lugubris	1.47
guttulata	
torquata	1.54

The difference in length between the outer pair of rectrices and the longest ones ranges between one-fifteenth and one-eighth of the length of the tail. The graduation is greatest in *torquata* and least in *maxima.*

	No. of specimens	Average length of tail	Average amount of graduation	Graduation in length of tail
torquata	(10)	119.8	12.5	9.6 times
lugubris	(3)	110.7	9.	12.3 "
guttulata				
alcyon	(12)	88.2	6.9	12.8 "
maxima	(2)	115.5	8.1	14.3 "

Feathering of tibia.— The lower end of the tibia is completely bare in all species, the unfeathered space being least extensive in *M. lugubris* in which it is only equal to the short chord of the claw of the hallux. In *alcyon* the bare space always exceeds this distance and usually equals or exceeds the long (upper) chord of the claw. In *torquata* and *maxima* the bare area is distinctly greater than the long chord.

Tarsus.— In the length of the extremely short tarsus there is remarkable uniformity. The tarsus in all five species is almost exactly equal in length to one and one-half (1½) times the long chord of the hallux claw. Compared with the inner toe (without claw) the tarsus is always distinctly shorter, fully one millimeter in *alcyon* and *torquata.*

Toes.— The hallux is distinctly to decidedly shorter than its claw (the toe being measured either along its upper surface or along its outer side from the seam crossing its base to the end, above); and the hallux and claw combined are shorter than the inner toe without claw.

The proportionate length of the anterior toes is very constant. The second toe with its claw is *always* longer than the fourth toe without its claw. At least this rule is so nearly invariable that in the forty-six specimens examined there is only one complete and one partial exception.

Comparing the second toe with the third we find that the second (with claw) is normally, except in *M. maxima,* equal to or a trifle longer than the third (without claw). This proportion holds in four-fifths of the specimens of *torquata* and *alcyon* examined, and in all eight individuals of *lugubris* and *guttulata.*

In *maxima* the second toe averages a little shorter than in the other species, being as often shorter than the third as longer. In all the species, however, except in the single aberrant individual of *torquata* and (one foot only) in one specimen of *maxima,* the second toe (with claw) never falls short of the third (without claw) by more than a mere trifle.

By means of the appended table the variations in this character may be easily seen.

Second toe with claw compared with third and fourth toes without claws.

alcyon, 18 spec.	= or rather slightly > 3 always distinctly > 4 (exc. two birds and one foot of two more).
torquata, 15 spec.	= or very slightly > 3 (except in three birds). almost always > 4 (< 4 in one bird).
lugubris, 1 spec. *guttulata,* 7 spec.,	= or slightly > 3 always > 4
maxima, 5 spec.,	= or slightly > 3 or slightly < 3 always > 4 (except in one foot of one bird).

Color.— The essential color characters of the genus have already been briefly mentioned. They are, first: the general lusterless gray coloration of the upper parts, the female with a chest-band of the same color (a subfamily character).

The white variegation of the scapulars, remiges, and rectrices and of the upperparts (when not uniform) is always in the form of small spots and bars, never in large areas, excepting only on the inner webs of the primaries in two species.

In the male the axillars and lower wing coverts are always pure white (the latter barred with gray in *M. maxima sharpei*), in the female (excepting only the coverts in *M. alcyon*) rufous.

With the exception of *M. alcyon* the chest-band of the male is rufous or rusty, but *torquata, lugubris* and *guttulata* are actually intermediate between *alcyon* and *maxima* in this respect.

The uniform unspotted grayish blue of *M. alcyon* and typical *M. torquata* seems at first sight very different from the gray and white barring of *M. lugubris* and *M guttulata*, but the latter do not differ *essentially* from true *M. maxima*, and this is connected with *M. t. torquata* by *M. t. stellata* and *M. maxima sharpei*.

In *alcyon* and *t. torquata* the upperparts are uniform grayish blue, a few small white spots tipping the wing coverts, and the upper tail coverts more or less spotted; but in *torquata* the former are usually obsolete and the latter concealed.

In *M. t. stellata* the feathers of the upperparts are slatey-black basally and along the shaft, and more or less marked with small spots of white.

This is a close approach to *M. m. maxima*, in which the entire basal portion and center of the feathers are blackish, the gray remaining as a wide border. The entire upperparts are conspicuously dotted with small spots of white. In *M. m. sharpei* the white spotting is greatly reduced, absent from the interscapulars and barely indicated on the crest.

In *M. guttulata* the white markings, except those of the wing coverts, take the form of broad bars, rather than small spots, usually reaching or crossing the shaft; and in *M. lugubris* this barring is even more pronounced. It is obvious, however, that the bars of these species correspond to the spots of *maxima* and may have been developed from that type of marking. In the Asiatic species the ground color of the upperparts is a slatey gray; the bluish shade so characteristic of the other members of the genus is less evident and exists only in light bluish-gray margins.

In the pattern of the primaries there is essential agreement between the three Old World species. Each web of all the quills is symmetrically marked with a series of white spots, which, on the outer web at least, extend well towards the tip.

The New World species are decidedly different and do not agree so closely with each other. The primaries are more extensively black terminally (without spots), while proximally there is a large white area on the inner web of each feather, particularly extensive in *alcyon*, in which the outer half dozen quills are practically wholly white on the basal half of the inner vane. In *torquata* the shaft is bordered by black, which runs out irregularly into the white area, and in extreme cases breaks it up into four or five smaller patches which, however, are always coalescent along the inner edge of the feathers.

In *alcyon* the outer web of all the primaries is more or less irregularly spotted, barred or even longitudinally marked with white, while in *torquata* at least the first three primaries and usually several others are wholly unmarked or at most with a mere indication of some of the spots on the margin. Both species vary greatly in the extent and character of these markings.

The differences in the coloration of the underparts presented by the four more distinct species of the genus are curious and interesting.

The only invariable characters in either sex are the rufous axillars and gray chest-band of the females, and the white axillars of the males. This difference in the axillars is thus the only sexual color distinction that holds in all the species. The coloration of each sex may be summarized as follows:

Male.— Under wing coverts and axillars always white (*i. e.*, without rufous; in *M. m. sharpei* the coverts, at least, are barred with dark gray and white). Chest-band rufous (paler, with slatey spotting, chiefly below the surface, in *lugubris* and *guttulata*; encroached upon by the blue gray of the sides in *torquata*), except in *alcyon* in which it is blue-gray as in the female. Belly white, except in *torquata*, in which it is rufous, continuous with the rufous chest-band. Sides of the body with a longitudinal slatey patch in *alcyon*, barred with slatey in the other white-bellied species; in *guttulata* and *lugubris* this extends as a zone of sparsely barred feathers across the abdomen, and in *M. m. sharpei* the entire underparts posterior to the chest-band are closely barred.

Female.— Chest-band always gray (solid in the New World, spotty in the Old World species); axillars always rufous; under wing-coverts also rufous in all but *alcyon*. The belly solid rufous in *maxima* and *torquata*, wholly white in *lugubris* and *guttulata* and intermediate in *alcyon*, being white with a narrow band of rufous across its anterior border and broadly rufous on the sides.

According to the coloration of the underparts the species may be diagnosed as follows:

♂ with gray chest-band (and white belly); ♀ with belly partly rufous; ♀ with white under wing-coverts	*alcyon*
♂ with rufous belly (♀ with belly wholly rufous)	*torquata*
(♂ with white belly) ♀ with belly wholly white	*lugubris* *guttulata*
(♂ with white belly) (♀ with belly wholly rufous)	*maxima*

The characters enclosed in parentheses are those not confined to any one species. It is seen that *alcyon* may be diagnosed by the color of the underparts in each sex, *torquata* by that of the male, *lugubris* and *guttulata* (taken together) by that of the female. In *maxima*, only the combination is characteristic, that of neither sex alone being distinctive.

Megaceryle alcyon.

Small *Megaceryle* (wing under 170 mm.), with slender bill, long wing tip (tenth primary always nearer seventh than sixth), the male with blue-gray chest-band and no rufous, the female with white under wing-coverts and white belly bordered anteriorly and on the sides with rufous.

Small Nearctic *Megaceryle* (wing under 170 mm.), with short and slender bill, the tomial serrations sometimes obsolete, the crest distinctly double, the vertical portion well developed, composed of narrow, pointed feathers, the barbs of which are extensively disconnected, the wing decidedly pointed (the tenth primary always nearer the seventh than the sixth in length, often longer than the seventh), the tail rather short, the rectrices somewhat pointed, the outermost pair falling short of the longest by about one-thirteenth of the length of the tail, the second toe with claw almost always equal to or longer than the third toe without claw, and always distinctly longer than the fourth without claw; the entire upperparts uniform bluish gray without white markings except on the wing- and tail-coverts, the basal half of the inner web of the outer five primaries almost entirely white, a solid blue-gray chest-band in both sexes, the adult male without rufous, the female with rufous sides and narrow band across lower breast, large white abdominal area and white under wing-coverts.

M. alcyon is the most distinct species of the genus, possessing several characters separating it at once from all its congeners. Its small size, slender bill, pointed wing, the pattern of the primaries, the absence of rufous in the male, and its peculiar distribution in the female (particularly its absence from the lower wing-coverts), are all diagnostic of this species.

It is a typical *Megaceryle*, however, in the essential generic characters, showing no approach in these respects either to *Ceryle* or to *Chloroceryle amazona*. While it agrees with these in size and with the former in its pointed wing, it is probable that both these resemblances are due to parallelism or convergence and do not indicate any particularly close relationship between those species and *M. alcyon*.

It is undoubtedly most nearly allied to *M. torquata* with which it agrees in the clear ashy-blue coloration. This relation is also shown in the pattern of the remiges and rectrices, by the presence of rufous on the under side of the body in the ♀ and by the form of the crest feathers. It is distinguished from *M. torquata* chiefly by the same characters in which it differs from the other species (particularly from *M. maxima*), *i. e.*, the characters peculiar to *M. alcyon*.

While the presence in the male of a chest-band of the same color as the upperparts and wholly without rufous, separates this species not only from all its congeners but from all the species of *Chloroceryle* as well, *M. torquata* and the Asiatic species show an approach to this style of coloration. In *M. torquata* the sides of the chest are blue-gray; in *M. lugubris* and *M.*

guttulata the sides of the chest are slate-gray and the feathers of the chest are extensively slate-color below the surface (visible to a slight extent), while the rufous is reduced to a pale superficial wash.

Probably the most remarkable variation in *M. alcyon* is found in the markings of the outer webs of the primaries, which present very diverse patterns.

Despite its wide range the geographic variations in this species are so slight that it is unnecessary to enter into them here. One geographic race has been described.

Megaceryle torquata.

Megaceryle with entire lower breast and belly solid rufous in both sexes.

Large, Neotropical *Megaceryle* with long or moderately long, stout bill, the culmen only slightly decurved for its distal one-third, relatively rather short crest the feathers of which are narrowed terminally, the tenth primary varying from decidedly shorter than the sixth to decidedly longer than the sixth, but always nearer the sixth than the seventh, the tail rather long, the rectrices somewhat pointed, the outermost pair falling short of the longest by between one-ninth and one-tenth of the length of the tail, the second toe with claw usually equal to or very slightly longer than the third toe without claw and almost always longer than the fourth without claw; the ground-color of the upperparts bluish gray, the crest never spotted with white, the primaries not symmetrically spotted with white on both webs, the outer three with, at most, vestigial spots on the outer web, the white on inner webs in large areas, not in isolated spots, the entire lower breast and abdomen uniform rufous in both sexes, the female with rufous under wing-coverts and a solid blue-gray chest-band, the male with the sides of the chest blue-gray.

M. torquata is distinguished from all its congeners by the uniform solid rufous of the breast and belly in both sexes. It has few if any other peculiar characters.

The crest is relatively smaller than in the other species, its feathers terminally narrowed and pointed as in *M. alcyon*.

The tail averages relatively longer than that of any other species, and with the shortest outermost rectrices. The difference in length is most pronounced, though not important, between *torquata* and *alcyon*, which, however, agree most closely in the form of the rectrices, these being more pointed and apparently narrower than in the other species.

In *M. torquata* the tenth primary averages slightly longer than in the Old World species, thus approaching *M. alcyon*, and the coloration shows several decided points of resemblance to the latter. This is evident in the color of the upperparts, the pattern of the remiges and rectrices, and the presence of rufous on the belly of the female.

On the other hand, in the rufous chest of the male, in general size, and in the size and form of the bill, *torquata* agrees with *maxima* and, in the first two respects, to a less extent, with *lugubris* and *guttulata*. *M. torquata* therefore connects *M. alcyon* with the other species of the genus.

At least three races of *M. torquata* are recognizable, but the geographical variations in this species have never been thoroughly worked out. As this is beyond the scope of the present paper no attempt has been made to revise the subspecies.

True *M. torquata* inhabits Middle America; the form of northern and eastern South America is probably the same. *M. t. stellata* is accredited to western and southern South America (Chili, Bolivia, and Peru), but its range and characters have never been thoroughly determined. Its characters are supposed to be a shorter bill than true *torquata*, the upperparts spotted with white, the slatey centers of the feathers broader. These alleged color characters, however, may be due, to a certain extent at least, to age, immature birds exhibiting the coloration above described. On the other hand, it is possible that two races of *torquata* with short bills are recognizable, one colored like true *torquata*, the other marked as above. Of most interest in the present connection is the short bill, relatively stouter than in *M. t. torquata* (but of which I have given no measurements owing to lack of perfect adult specimens) and the coloration suggestive of *M. maxima*.

M. t. stictipennis Lawrence, of Guadeloupe, Lesser Antilles, of which I have examined two adult males, including the type, is, judging by these specimens, an easily distinguished form, chiefly characterized by the large amount of white in the plumage. The white bars on the rectrices are much better developed than in true *torquata*, there is a greater amount of white on the primaries and primary coverts (usually little or none on the latter in true *torquata*), and more white specks and narrow bars on the upper parts (largely concealed). The rufous of the underparts probably averages decidedly deeper and of a slightly different shade. The slatey stripes of the crest feathers are reduced to a minimum.

This form, while included in the British Museum Catalogue, is omitted from the Hand-List of Birds.

Megaceryle maxima.

Megaceryle with the belly white (with or without gray bars) in the male, solid rufous in the female.

Large African *Megaceryle* with large, stout bill, the culmen gently decurved for its terminal third, long vertical and occipital crest with broad tipped feathers, the tenth primary ranging between the fifth and sixth in length, the tail rather short, the outermost pair of rectrices falling short of the longest by about one-fourteenth of the length of the tail, the second toe with claw about equalling the third toe without claw, usually longer than the fourth toe without claw; the feathers of the upperparts with conspicuous slate-colored or blackish centers, those of the crest and rump

(at least) more or less spotted with white, the primaries symmetrically spotted with white on both webs, the male with a rich rufous chest-band but no rufous elsewhere, the female with the chest heavily marked with slate-gray, the entire abdomen and the under wing-coverts rufous.

M. maxima is well characterized by the coloration of the lower parts, no other species combining a rufous chest-band and white belly in the male, with a rufous belly in the female. (In the male of *M. maxima sharpei* the belly is heavily marked with slate color but it is never rufous.) The male is essentially similar in pattern to the males of *M. lugubris* and *M. guttulata,* the females of which have no rufous on under surface of body; while the female resembles that of *M. torquata,* the male of which has a rufous belly. *M. maxima* is therefore the only species in which the male has the entire belly white (*i. e.*, without rufous) while the female has it entirely rufous.

Aside from the coloration of the underparts *M. maxima* has no strongly marked peculiar characters. In the coloration of the upperparts it is to a certain extent intermediate between the two New World species on one hand, and the two Asiatic forms on the other hand. In the pattern of the remiges and rectrices, and in the size of the crest and its feathers it agrees with *M. guttulata,* while in the size and form of the bill it is similar to *M. torquata.* In the proportions of the primaries, the length and form of the tail, and the form of the rectrices there is close agreement with *M. lugubris* and *M. guttulata,* but *torquata* does not differ importantly in any of these respects.

The anterior toes show the Megaceryline proportions less strongly than in other species, the second toe with claw being frequently shorter than the third toe without claw, which is only rarely or abnormally the case in the other species.

In addition to the typical subspecies, *M. m. maxima,* one well marked race is recognized, *M. m. sharpei* of West and Equatorial Africa. This form, of which I have seen no specimens, differs from true *maxima* in its darker coloration, the white spots of the upperparts much restricted and wholly absent from the interscapulum; the abdomen, crissum, under wing-coverts (and axillars doubtless) of the male, heavily barred with slate-gray.

Whether or not there are any differences in form or proportions between the two races I am unable to state, but it is probable that there are none of any importance.

Megaceryle guttulata.

Megaceryle with short, stout bill, the maxilla decidedly decurved for more than its distal third and with laterally thick tip, the entire upperparts conspicuously barred with gray and white, the crest with two patches of almost wholly white feathers, the male with pale rufous chest-band which is spotted with slate-gray below the

surface, and a pale rufous spot on posterior malar region, the female with no rufous below, except on axillars and under wing-coverts.

Ten or eleven white spots on outer web of outer rectrix (including base and tip), the spots on proximal half of quill not wider than the dark interspaces, mostly much narrower; the distance between the distal white spot on inner web of outer three primaries and the tips of the quills greater than the depth of the bill; the white bars of the upperparts (including the scapulars) narrower than the dark bars, those of the rump little if any wider.

Rather large Asiatic *Megaceryle* with short but stout bill, the maxilla decidedly decurved for more than its distal third, and with laterally thick tip, very large crest, the vertical part highly developed, the feathers with broad truncate tips, the tenth primary ranging in length between the fifth and sixth, the tail of moderate length, the outermost pair of rectrices falling short of the longest by about one-twelfth of the length of the tail, the second toe with claw usually equal to or slightly longer than the third toe without claw and always (?) longer than the fourth toe without claw, the upperparts conspicuously barred with dark gray and white, some of the crest feathers pure white with, at most, one or two small black spots at the tip, the primaries symmetrically barred with white on both webs, the male with pale rufous chest-band (spotted with slate-gray below the surface) and pale rufous spot on posterior malar region, the female with white underparts, only the axillars and under wing-coverts pale rufous, a band of gray spots or bars crossing the chest. (To this may be added the minor color characters, distinguishing *guttulata* from *lugubris*, given in the second paragraph of the diagnosis.)

Megaceryle lugubris.

Megaceryle **similar to *M. guttulata*, but differing in greater amount of white in the plumage.** About thirteen white spots on the outer web of the outer rectrix (including base and tip), the spots on proximal half of quill much wider than the dark interspaces; the distance between the distal white spot on inner web of outer three primaries and tips of quills less than the depth of the bill: the white bars of the upperparts (including the scapulars) mostly as wide as or wider than the dark bars, much wider on the rump.

M. lugubris and *M. guttulata* are very closely related, differing from each other only in the relative amount of slate color and white in the plumage, while agreeing exactly in several important characters not found in any other species.

The short but thick bill, with decurved maxilla and thickened tip, is the only marked structural peculiarity. In coloration the unique features are the broad, white barring of the upperparts, the pallor of the rufous shade and its restriction in the female to the under wing-coverts and axillars, and, in the male, the presence of a rusty malar spot and a concealed slatey chest-band, superficially rusty. The last feature is an approach to the unique blue gray chest-band of *M. alcyon*, and the shortness of the bill is another resemblance to the latter.

It is probable, however, that these resemblances are due to convergence, for the nearest ally of the Asiatic species is unquestionably *M. maxima.*

This relationship is shown in the crest, the proportions of the primaries, the length and form of the tail and rectrices, and to a considerable extent in coloration, particularly in the pattern of the remiges and rectrices. The barring of the upperparts is only an exaggeration of the spotting of *M. maxima.*

The gray and white coloration of the Oriental species bears a superficial resemblance to the black and white of *Ceryle*, and the similarity is increased by the pallor and restriction of rufous on the underparts. It was for this reason, doubtless, that Reichenbach separated them from their congeners and placed them in *Ceryle.* Even in coloration, however, *M. lugubris* and *M. guttulata* are essentially Megaceryline and differ in important respects from *Ceryle*, particularly in the pattern of the individual feathers.

While *M. lugubris* and *M. guttulata* are very nearly related I have followed Dr. Stejneger[1] in considering them as specifically distinct. *M. lugubris* appears to be an island form confined to Japan, and as far as known the differences separating it from the continental *M. guttulata* are constant. The two species are distinguished by the relative amount of gray and white in the plumage. I have a single fine specimen of *lugubris* and six (three from India and four from North China) of *guttulata* for comparison. These exhibit the following differences.

	M. lugubris.	*M. guttulata.*
Primaries	A white spot on inner web opposite the subterminal spot on outer web of outer three or four primaries	*No* white spot on inner web opposite the subterminal spot on outer web of outer three or four primaries.
10th primary	Nine or ten white spots on inner web (including base). Nine past tip of spurius primary.	Eight white spots on inner web (including base). Seven or eight past tip of spurius primary.
	Distance of last spot on inner web from tip is less than greatest depth of bill.	Distance of last spot on inner web from tip is more than greatest depth of bill.
Innermost large secondary	White bars not conspicuously narrower than dark bars,—fully three-fourths as wide.	White bars much narrower than dark bars, only about one half as wide.
Scapulars	Many of the white bars are broader than the dark ones.	The white bars are always narrower than the dark ones (except near the base of some feathers).
Central rectrices	White base reaching shaft.	White bars not reaching shaft.

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[1] Proc. U. S. Nat. Mus., XV, 1892, 294.

	M. lugubris.	*M. guttulata.*
Outer web of outer rectrix	Thirteen well-defined spots including base and tip.	Ten or eleven well-defined spots, including base and tip.
	On basal half the white spots are much wider than the dark spaces, often twice as wide.	On basal half the white spots are not wider than the dark spaces, mostly much narrower.
Rump	Many of the white bars are nearly or quite twice as wide as the dark ones.	White bars little if any wider than the dark ones.
Upper tail-coverts	White bars mostly equal or exceed dark ones in width.	White bars are narrower than the dark ones.

Genus **Ceryle**.

Medium sized Ceryline Kingfishers with slender bill, the sides of the mandibular rami overlapped by the interramal feathers; coloration wholly black and white, the feathers of the upperparts black with at least the tips white, the wing with a large white area covering both webs of several adjacent primaries, the plumage of the throat with a satiny lustre, the male with two black bands crossing the breast.

Medium sized Ceryline Kingfishers of Africa and Asia (the wing less than 145 mm. long) with rather long, slender, non-serrate bill, the interramal feathers overlapping the sides of the mandibular rami, well developed occipital but no vertical crest, rather long, pointed wing (the tenth primary longer than the sixth), diastataxic secondaries, nearly even tail (the outer pair of rectrices falling short of the longest by less than one-fifteenth of the length of the tail), the rectrices with broad, obtusely rounded tips, the tarsus short hallux moderately short, the front of the tarsus covered with scales except at its upper end, the second toe with claw longer than the fourth without claw, and not shorter than the third; the plumage very soft, the feathers of the upperparts and crest with the barbs disconnected terminally and very fine, the throat and to a less extent the rest of the underparts with a satiny luster; the plumage wholly black and white, the feathers of the upperparts neither uniform nor marked with small spots or bars, but black with a white terminal margin and often more or less extensively white proximally, some of the primaries and secondaries and all of the rectrices with large continuous areas of white across both webs, one black band on the breast in the female and two in the male.

The exact relationship of *Ceryle* to *Megaceryle* and *Chloroceryle* cannot be satisfactorily determined until its muscular and skeletal anatomy have been examined.

Coloration is the most distinctive feature of *Ceryle*. This differs so markedly in several respects from the characteristic styles of the allied genera that it may be considered an excellent distinction. Aside from coloration there are no very strongly marked characters separating *Ceryle* at once from both of the other genera, but the slender bill with its rami overlapped by feathers, and the soft, satiny texture of the plumage are also diagnostic. The scaled podotheca and diastataxic wing are the most important characteristics allying it to *Megaceryle* and distinguishing it from *Chloroceryle*, while in the absence of a vertical crest it agrees with the last-named genus and differs from the first. Its differences from *Chloroceryle* would be much more pronounced were it not for the intermediate nature of *C. amazona*.

To the following list of characters may be added "Geographical distribution" as a distinction between *Ceryle* and *Chloroceryle*.

Ceryle agrees with

Chloroceryle:

- Smooth tomia (but approached by *M. alcyon*).
- Length of tarsus and hallux (but former closely approaching *Megaceryle*).
- Slender feet.
- Crest (with *C. amazona* only and is a little further from the three other species than is *C. amazona*).
- Size.

Megaceryle:

- Diastataxic.
- Primary formula.
- Scaled podotheca (but approaching *Chloroceryle*).
- Length of bill (but differing less from *Chloroceryle* than from the two short-billed species of *Megaceryle*).
- Fore-toes: second relative to third and fourth (but agrees with *C. amazona* also).
- Length of anterior toes.

Neither (*unique*).

- Slender bill (but only *averaging* slenderer than the slenderest billed species of *Chloroceryle*).
- Graduation of tail (but little different from *Megaceryle* and *C. amazona*).
- Form of rectrices.
- Interramal feathering.
- Texture of plumage, very soft, hairy and with a satiny lustre.
- Color and pattern of upperparts, wings and tail.
- Color and pattern of underparts (sexual coloration and absence of rufous).

The bill is very straight and is much more slender than that of *Megaceryle* (particularly the larger species) and *Chloroceryle inda*; from the three other species of *Chloroceryle* there is only an average difference but, except in *C. americana*, this amounts almost to a constant distinction.

In the graduation of the tail *Ceryle* differs but slightly from *Chloroceryle amazona* and the species of *Megaceryle*, *M. maxima* approaching it most closely. The rectrices are noticeably broader and more obtuse at the ends than in the allied genera. The difference from *M. alcyon* and *M. torquata* is most pronounced, and, particularly in the outer pair of rectrices, from the three smaller species of *Chloroceryle*.

The overlapping of the sides of the mandible by the interramal feathers is usually conspicuous in *Ceryle*, and slightly if at all developed in the other genera.

The plumage of the upperparts is soft and smooth in *Chloroceryle* but even more so in *Ceryle*. The more or less disconnected barbs are extremely fine and soft, giving the crest, in particular, a hairy aspect. The plumage of the throat is satiny white with a strong lustre, and this is shown to a less extent by the rest of the underparts.

Most of these characters, peculiar to *Ceryle*, are not very important, yet collectively they emphasize the distinctness of the genus. As already stated, however, it is by coloration and by a different combination of the characters found in the related genera that *Ceryle* is best distinguished.

The single species constituting the genus *Ceryle* stands quite alone in coloration. It is wholly black and white, with no rufous or fulvous in either sex or at any age, differing in both respects from all the species of *Megaceryle* and *Chloroceryle*. It is unique in the conspicuous white terminal margins to all the feathers of the upperparts and the large white areas in the primaries, secondaries, and rectrices (and the wing- and tail-coverts also). An approach to this condition (in the secondaries and tail only) is seen in *Chloroceryle ænea* and particularly in *C. americana*, but the resemblance is by no means close.

While the sexes are distinguished by the banding of the underparts as in other Cerylinæ, there is an important difference in this respect between *Ceryle* and the two related genera. Both sexes have a broad black chest-band narrowing towards the median line and there interrupted in the female, while the male has, in addition, a second, narrower but complete band crossing the lower breast.

Thus the female agrees with the female of all the species of both *Chloroceryle* and *Megaceryle* in having a chest-band of the same color as the upperparts (the resemblance to the female of *C. amazona* is particularly close, in the white underparts, interrupted chest-band and dark-marked sides).

In these genera, however (with the exception of *M. alcyon*), the dark chest-band of the female is replaced by a rusty band in the male. In *M. alcyon* the band remains as in the female, while in *Ceryle* this band becomes complete and there is a second band back of it. This is a feature unknown in the other genera.

There was formerly some uncertainty as to whether or not there is a sexual difference in coloration in *Ceryle*, and as late as 1905[1] doubts were expressed as to there being any difference in this respect between the male and female. In my opinion there can no longer be any question but that the sexes differ as above described. The uncertainty was caused by the fact that the immature male has but a single band as in the female.

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[1] Oberholser, Proc. U. S. Nat. Mus., XXVIII, 1905, 851.

Sharpe, in his 'Monograph,' quoted the opinion of Dresser, based on "a very large series," that the sexual differences are as above described. He also quoted Dr. Tristram as follows: "I preserved twenty-one specimens and many were collected by others of the party. In all the sex was carefully noted and the rule held good of the male having a second band, which was wanting in the female and young bird."

Sharpe adhered to these distinctions in the 'Catalogue of the Birds in the British Museum' (1892), and as he there listed 183 specimens of *Ceryle rudis* and *varia*, the material on which to base his conclusions was surely ample.

The small series available in the present connection includes only ten specimens in which the sex was determined by the collector, and, I believe, includes those on which Mr. Oberholser based his remarks. Of these, five are double-banded and these are all marked ♂; five have but a single band, and four of them are marked ♀, while one, an immature bird is sexed as a ♂.

Ceryle rudis rudis and *C. r. leucomelanura* (*varia* of authors, in part, not of Strickland which is based on the South African bird; *cf.* Hartert, Nov. Zool., XVII, 1910, 216) are strongly marked subspecies. The series examined included birds from Cape Colony (1), Natal (1), British East Africa (4), Egypt (2), India (6), and China (2). The latter belong to *C. r. insignis* Hartert, distinguished by its longer bill.

The Asiatic specimens may be invariably distinguished from the African by the characters given below, but as I have seen no specimens from the region lying between Egypt and India (Palestine, Persia, and Baluchistan), in which the ranges of the two forms meet, it seems better to treat them as subspecies. That intergradation is not improbable is indicated by the specimens from Egypt which show a decided approach to *C. r. leucomelanura* in both size and coloration. Indeed there is probably no material difference in size between birds from Egypt and India.

There is little doubt that *Ceryle rudis rudis* is a composite form and separable into at least two races, but as the single skin from Cape Colony equals the Egyptian birds in size it seems inadvisable to describe any new forms from the meagre series available.

C. r. rudis may be distinguished from the two Asiatic races by the following characters:

C. r. rudis.— White areas less extensive throughout than in the other forms. Basal two-fifths of the tail more or less marked with black, the shaft (in this space) always partly or wholly blackish or dusky. White of the primaries and secondaries less extensive; the first primary that is broadly pure white, completely across both webs is the sixth or fifth. The black spots on the sides are narrower and confined mostly to one web. Throat never spotted with black.

C. r. leucomelanura et *insignis.*— White areas everywhere more extensive than in *C. r. rudis.* Basal two-fifths of the tail always pure, immaculate white, the shaft (in this space) with no blackish or dusky. White in primaries and secondaries more extensive; the first primary that is broadly pure white completely across both webs is the eighth (more rarely the ninth or seventh). The black spots on the sides are rounder or broadly cordate and spread nearly equally on both webs. Lower part of throat usually spotted with black.

Genus **Chloroceryle**.

Eutaxic Ceryline Kingfishers with glossy green upperparts and scaleless podotheca.

Very small to medium-sized Ceryline Kingfishers of the Neotropical Region (the wing less than 145 mm. long), with rather slender to rather stout bill, the tomia perfectly smooth, without vertical crest, a short blended occipital crest present (longer and less blended in *C. amazona*), the tenth primary shorter than the sixth, the secondaries eutaxic, the tail graduated for one-fifth or one-sixth of its length (or, in *C. amazona* for only one-thirteenth), the tarsi covered only with skin and wholly without scales, the tarsus and hallux moderately short, the second toe with claw shorter than the third without claw and rarely longer than the fourth without claw (excepting in *C. amazona*); the plumage uniform, glossy, metallic green above, the chest always rufous in the male; no sexual difference in the color of the axillars.

Excluding *C. amazona* the short diagnosis can be enlarged as follows:

Very small to rather small eutaxic Ceryline Kingfishers (the wing less than 105 mm. long), with short, blended occipital crest, the tail graduated for more than one-seventh of its length, the podotheca scaleless, the second toe with claw shorter than the third without claw and rarely longer than the fourth without claw, the upperparts glossy green.

Bill. — The bill is not exactly alike in form or proportions in any two species of *Chloroceryle*. *C. amazona* and *C. ænea* closely agree in the length of the bill (proportionate to the bird itself), and in its relative depth. They hold a central position in these respects, as in *C. inda* the bill is decidedly shorter and thicker, while in *americana* it varies equally in the opposite direction being the longest and most slender.

In the following table the figures in the first column give the relative length of the bill compared with the distance from the bend of the wing to the tips of the lower primary coverts. The second and third columns give the extremes and average of the relative depth of the bill, the figures expressing the number of millimeters by which four times the depth of the bill at the gonydeal angle is less than or exceeds the length of the bill from the anterior end of the nostril.

	Length	*Depth*	
inda	1.05	+ 1 to 4	+ 2.8
amazona	.98	− 2.3 to + 2	− .6
ænea	.98	— 3 to + 2.5	+ .8
americana	.91	— 4 to + .5	— .2

In a single aberrant specimen of *C. amazona* the bill is distinctly slenderer than in those included in the above table, four times its depth being less than the length by 5.5 mm.

Crest.— In the three smaller species the feathers of the occiput are decidedly lengthened and form a short blended crest. In *C. amazona* they are considerably longer, narrower and less blended and the crest is more conspicuous.

Wing.— The outermost (tenth) primary normally ranges between the sixth and fourth, rarely reaching the third in one species.

In *C. amazona* the outer primary is always longer than the fifth and in *C. americana* usually longer; in *C. inda* and more southern specimens of *C. ænea* it does not exceed the fifth, while more northern specimens of the latter agree with *C. americana*. The proportions in more detail are as follows:

C. amazona (13 specimens) P. 10 slightly > 5 to nearly $= 6$ (averaging nearer 5).

C. americana (22 specimens) P. 10 a trifle < 5 to a trifle < 6 (usually between 5 and 6. Birds from Texas and Mexico do not differ from South American specimens).

C. inda (6 specimens) P. 10 distinctly > 4 to $= 5$ (averaging about half way between 4 and 5).

C. ænea 1. (4 specimens from Vera Cruz, Mex.) P. 10 a trifle < 5 to < 6 (equidistant between 5 and 6).

2. (12 specimens from Honduras southward) P. 10 $= 3$ to $= 5$ (usually distinctly > 3).

Tail.— *C. americana* is the longest tailed species and *C. amazona* and *C. ænea* are the shortest; *C. inda* is intermediate but is decidedly nearer *americana*.

The following figures express the relative length of the tail in each species, comparison being made with the distance from the bend of the wing to the tips of the longer lower primary coverts. Thus in *C. amazona* the tail is equal to one and four-tenths of this distance, in *americana* to one and two-thirds. The entire range of variation, therefore, amounts to only one-fourth of the above measurement.

amazona	1.40
ænea	1.44
inda	1.59
americana	1.66

In the three smaller species the outer pair of rectrices is conspicuously shortened, the graduation of the tail amounting to one-fifth of its length in *americana* and *inda*, and to one-sixth in *ænea*. In *amazona* the abbreviation of the outer quills is much less — not quite one-thirteenth of the length of the tail.

	No. of Specimens.	Av. length of tail.	Av. amount of Graduation	Graduation in Length of Tail
amazona	(10)	79.	5.9	13.4 times
ænea	(7)	35.4	5.8	6.0 "
inda	(6)	64.8	12.6	5.1 "
americana	(10)	56.7	11.2	5.0 "

Thus in the smaller species the graduation of the tail is correlated with its length, *americana* having the longest tail and the shortest outer rectrices, while *ænea* has the shortest tail and the longest outer rectrices.

Feathering of the tibia.—The lower end of the tibio-tarsus is perfectly bare in all species. The unfeathered space is, at its most restricted point, always equal to or greater than the lower (short) chord of the claw of the hallux, except in some specimens of *C. ænea*, in which the tiny feathers slightly encroach on this space.

In *C. ænea*, usually, and in some examples of *C. americana*, the bare space is equal to the short chord of the claw, in *C. inda* and most specimens of *C. americana* the unfeathered area exceeds the short chord of the claw; in *C. amazona* this area always equals or exceeds the upper (long) chord of the claw.

The length of the tarsus is about one and three-fourths to very nearly twice the long chord of the hallux claw.

Tarsus.—The tarsus compares with the inner toe (without claw) as follows:

amazona	Tarsus	distinctly shorter than inner toe.
inda	"	usually shorter than, sometimes =, inner toe.
americana	"	=, sometimes slightly shorter than, inner toe.
ænea	"	=, sometimes slightly longer than, inner toe.

C. ænea has a slightly longer tarsus than the other species.

Toes.—In the proportionate length of the anterior toes the three smaller species virtually agree. The second toe with claw is always shorter than the third toe without claw, and equal to or shorter than the fourth toe without claw.

In *C. amazona* the second toe with claw averages equal to the third without claw, and is almost always longer than the fourth without claw. *C. americana* shows a distinct approach to *amazona*. The exact proportions in each species are shown in the following table.

Second toe with claw compared with third and fourth toes without claw.

amazona, 10 specimens,	= 3, (a trifle < 3 in 4 birds, perceptibly > 3 in 2 birds).
	> 4, (slightly to very distinctly; in 1 bird = 4 in one foot, a trifle < 4 in other foot).

americana, 14 specimens, < 3, (slightly to very distinctly;
    = 3 in one foot of one bird).
  = 4, (10 birds = 4,
    2 " slightly < 4,
    2 " slightly > 4.)

inda, 6 specimens, < 3 always.
  slightly < 4 to = 4 (in one foot of 1 bird a trifle < 4).

ænea, 9 specimens, (< 3 always
  slightly < 4 to = 4 (in 5 birds = 4, in 4 birds a trifle < 4).

Color.—The uniform, dark, lustrous, metallic green of the entire upperparts, so unlike that of any other genus, is remarkably similar in all four species. It is lightest and most brassy in *amazona* and averages deepest or most saturated in *inda* and *ænea*, but there are no well marked constant differences.

The plumage is soft and blended and the color changes, according to the position in which the bird is held, from yellowish-green or brassy to deep bluish-green.

The wings, tail, and scapulars are spotted, barred or otherwise marked with white, chiefly on the inner webs or beneath the surface. The pattern varies with the species. The spotting sometimes invades other parts of the upper plumage as concealed markings below the surface of the dorsal feathers, or as spotting on the wing-coverts, rump, and upper tail-coverts.

The central pair of rectrices is unmarked in *amazona* and *ænea* and, at most, with a few small spots in *inda* and *americana*.

The other rectrices are more or less barred or spotted in all species but scarcely or not at all on the outer web except on the outer one or two quills in *amazona*, basally in *ænea*, and extensively in *americana* in which the outer three pairs are mostly white.

There is no sexual difference in the color of the axillars, lower wing coverts, belly, nor, except in *C. americana*, of the throat, the sex being ordinarily indicated only by the color of the chest.

The coloration of the underparts furnishes well marked specific characters. Thus, *C. amazona* stands alone in the pure white ground color of the underparts, the sides and flanks broadly striped with green and the green chest-band of the female interrupted in the middle. In *C. americana* the male has pure white underparts but in the female the throat and breast are more or less strongly tinged with buff. The sides are spotted with green and the upper belly is crossed by a band of green spots.

C. inda and *C. ænea* agree in the general rufous color of the underparts, including the axillars and under wing-coverts (the throat paler, ochraceous), but in *ænea* the entire center of the abdomen is white.

The bill and feet are wholly black in *amazona* and *americana* except for a touch of lighter color at the junction of the mandibular rami. In *inda* and *ænea* the feet and part of the lower mandible, including the proximal half of the gonys and a stripe along the lower edge of each ramus are light colored in skins and in life are probably red or orange.

Chloroceryle amazona.

Large *Chloroceryle* with well-developed occipital crest, the tail graduated for about one-thirteenth of its length, the second toe with claw not shorter than the fourth without claw, the primaries combining absence of white on their outer webs with large, continuous white areas on the inner webs, the green chest-band of the female incomplete, the sides broadly striped with green.

Large *Chloroceryle* with bill of moderate length and thickness, well-developed occipital crest, the feathers narrowed and not blended, the tenth primary longer than the fifth, the tail rather short and graduated for about one-thirteenth of its length, the second toe with claw not decidedly shorter than the third without claw, and not shorter than the fourth without claw, the dorsal plumage with no concealed white, the outer webs of the remiges without white, the inner webs with large, continuous white areas, rectrices without decided white basal area, with no rufous below except the chest-band of the male, the green chest-band of the female incomplete, the sides with broad stripes of dark green, the bill and feet wholly black.

C. amazona is the type of *Chloroceryle* and therefore of necessity "typical," but in the sense that it differs in certain characters from those shared by all the other species, it is a decidedly aberrant member of the genus.

In its well-developed occipital crest, nearly even tail, proportion of the anterior toes, and in general size it virtually agrees with *Ceryle,* though in the first mentioned character *Ceryle* is somewhat nearer *Megaceryle* than is *Ch. amazona.*

In its more pointed wing also it recalls *Ceryle.* In all these characters it also approaches or agrees with *Megaceryle* though the resemblance in the crest extends only to the occipital part.

In the most essential generic characters, as the eutaxic secondaries, glossy green upperparts, and rufous chest-band of the male, and in other more variable characters as the bill, this species is a typical *Chloroceryle,* showing no approach to *Ceryle.*

In the details of coloration there are well-developed specific features. The outer webs of the remiges are unicolorous green with no white spotting whatever. On the inner webs are extensive and continuous areas of pure white, never taking the form of spots. The tail is spotted with white on all but the central pair of rectrices, but there are no large white areas on any of the feathers, only the outer pair being completely crossed by white at the extreme base.

The metallic green chest-band of the female is wholly interrupted medially, taking the form of a blotch on each side of the chest. Both this feature and the green stripes on the sides are peculiar to the species. In the distribution of the rufous on the underparts, *C. amazona* agrees with *C. americana* in having only a rufous chest-band in the male and no rufous whatever in the female, but *C. amazona* altogether lacks the buff shade present on the underparts of *C. americana.*

The range of *C. amazona* extends from Mexico through Central America and over the greater part of South America to the Argentine Republic. No subspecies, however, are recognized and the geographical variation, if any, must be slight.

Chloroceryle americana.

Rather small *Chloroceryle,* with rather long, slender bill, at least the inner primaries conspicuously spotted with white on both webs, the outer three or four pairs of rectrices chiefly white, the underparts combining a complete green chest-band in the female with a rufous chest-band (and no rufous elsewhere) in the male, the flanks and a band across the upper belly spotted with green, the throat and breast of the female tinged with buff.

Rather small *Chloroceryle* with rather long, slender bill, slightly developed occipital crest, the tenth primary never more than a trifle shorter than the fifth, the tail relatively long and graduated for one-fifth of its length, the second toe with claw shorter than the third without claw and averaging equal to the fourth without claw, the dorsal plumage with concealed white, at least the inner primaries conspicuously spotted with white on both webs, the inner secondaries with entire basal portion conspicuously white, the outer three or four pairs of rectrices chiefly white, the rufous confined to a chest-band in the male and absent in the female, the sides and flanks spotted with green and a band of green spots across the upper belly, the throat and breast of the female tinged with buff, the bill and feet wholly black.

C. americana is a very well marked species related much more closely to *C. inda* and *C. ænea* than to *C. amazona,* but differing from them conspicuously in the restriction of rufous on the underparts (as in *C. amazona*), the white spotting of both webs of the remiges, and the large white areas on the inner secondaries and on the rectrices.

The coloration of the underparts is very distinctive. In the buff throat and breast of the female there is an approach to the deeper coloration of *C. inda* and *C. ænea,* but *americana* is unique in the genus in exhibiting any sexual difference in color other than that of the chest-band.

The bill is more slender than in any other species and, while the relative length of the toes practically agrees with that of *inda* and *ænea,* there is a slight approach to the proportions found in *C. amazona.*

C. americana is distributed over the greater part of South America and north to Texas. Four subspecies are at present recognized, differing somewhat in color and size, and to a slight extent in the thickness of the bill.

The proportionate length of the primaries is very constant, specimens from Texas and Mexico agreeing in this respect with those from South America (Colombia; Trinidad; Matto Grosso, Brazil).

Chloroceryle inda.

Medium sized *Chloroceryle* with short, thick bill, and with no white on the underparts, the entire belly rufous.

Medium sized *Chloroceryle* with short, thick (both horizontally and vertically) bill, slightly developed occipital crest, the tenth primary not exceeding the fifth, the rather long tail graduated for one-fifth of its length, the second toe with claw always shorter than the third without claw, and not exceeding the fourth without claw, the outer webs of the primaries and retrices unmarked or with a few minute white specks, the inner webs of the primaries with fulvous spots, no basal light areas on the outer webs of the secondaries, the feathers of the chest-band of the female white, crossed by two dark bars, the throat fulvous, the belly entirely rufous, the feet and lower edge of the mandibular rami orange in life.

C. inda is obviously related to *C. ænea* but is easily distinguished by its much greater size, spotted inner web of primaries, absence of light areas on basal portion of inner secondaries and rectrices, and of white on center of abdomen, and shorter, thicker bill. In none of these characters except the spots on the inner webs of the primaries does it show any approach to *C. americana*.

C. inda is distributed over much of South America and north to Nicaragua. No subspecies are at present recognized. With the possible exception of *C. ænea* this is the rarest of the four species of *Chloroceryle*.

Chloroceryle ænea.

Very small *Chloroceryle* without distinct light spots on the primaries, the abdomen rufous on the sides, white in the middle.

Very small *Chloroceryle*, with bill of moderate length and thickness, slightly developed occipital crest, the tail rather short and graduated for one-sixth of its length, the second toe with claw shorter than the third without claw, and not longer than the fourth without claw, no distinct light spots on the primaries, a light basal area across the inner secondaries and on the outer three or four pairs of rectrices, the feathers of the chest-band of the female barred, the throat fulvous, the abdomen rufous on the sides, white in the middle, the lower edge of the mandibular rami orange in life.

C. ænea is abundantly distinct in its extremely small size and unspotted primaries. Additional differences from *C. inda* are the presence of light basal areas on the inner secondaries and several outer rectrices, and the presence of a large white area on the center of abdomen.

It agrees closely with *americana* and *inda* in most details of form but has a distinctly shorter tail than *americana*, *inda* being intermediate. In this respect it is nearest *C. amazona*, and also slightly approaches that species in the graduation of the tail. Its bill is intermediate in length and form between the long, slender bill of *americana* and the short, thick bill of *inda*.

Three races are currently recognized, *C. ænea ænea* with an extensive South American range, *C. æ. æquatorialis* of Ecuador, and *C. æ. stictoptera* ranging from Panama to Mexico. It is probable, however, that the last-named race does not extend as far south as Panama. The only important difference in form between northern and southern specimens is in the wing formula. In the Mexican birds examined (four from Vera Cruz) the outermost (10th) primary varies from a *trifle* shorter than the fifth to decidedly shorter than the sixth (equidistant between the two). In twelve birds from Honduras and further south the tenth quill ranges from equal to the third to equal to the fifth, usually distinctly longer than the third.

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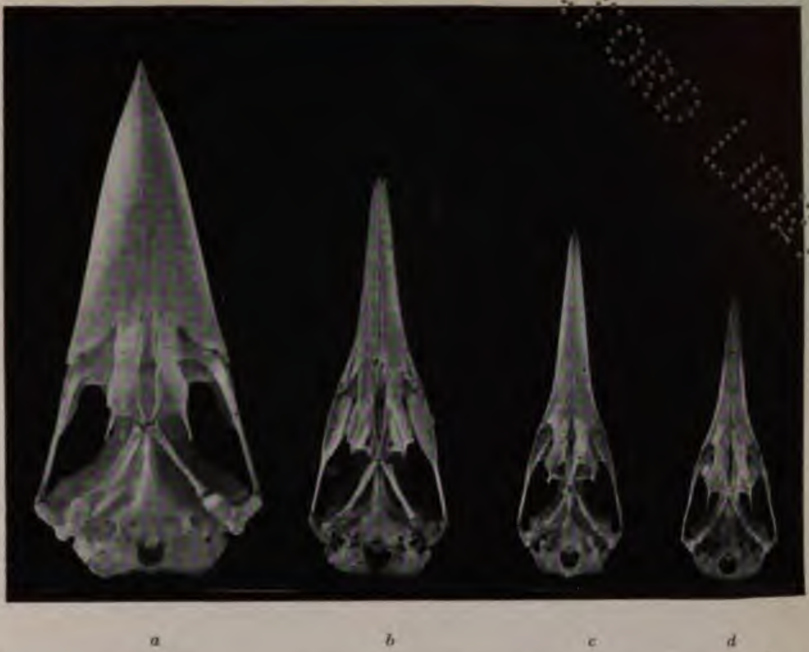

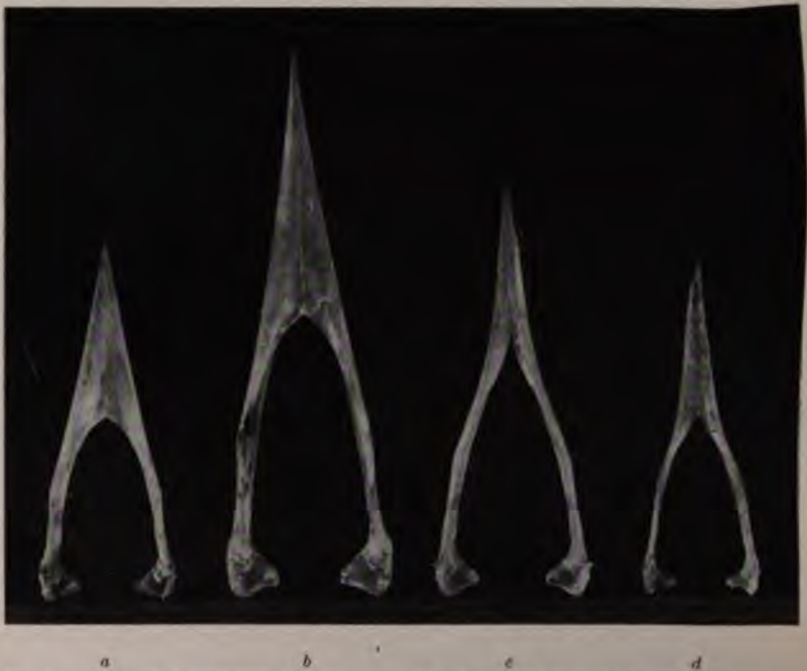

Fig. 1. Skulls of Kingfishers, palatal aspect ($\frac{2}{3}$ nat. size).

- *a.* Dacelo gigas.
- *b.* Megaceryle alcyon.
- *c.* Chloroceryle americana
- *d.* Alcedo ispida.

Fig. 2. Mandibles of Kingfishers, from below (nearly $\frac{4}{5}$ nat. size).

- *a.* Halcyon chloris.
- *b.* Ramphalcyon capensis.
- *c.* Megaceryle alcyon.
- *d.* Chloroceryle americana.

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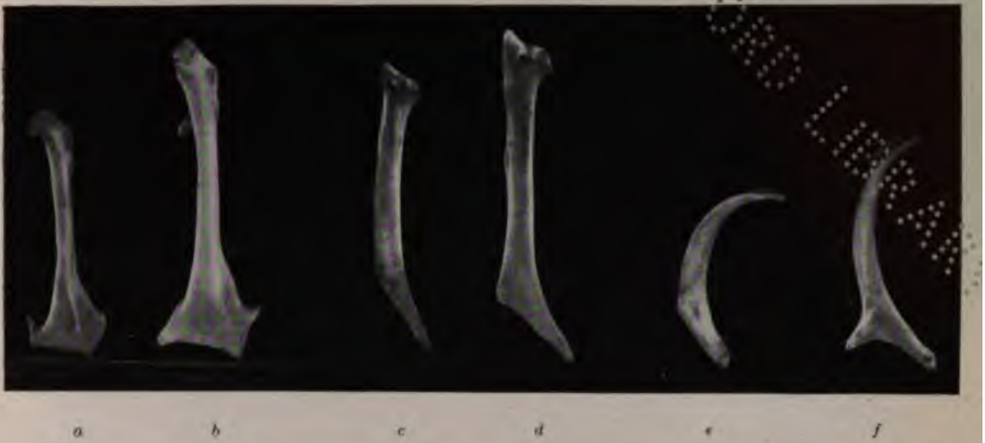


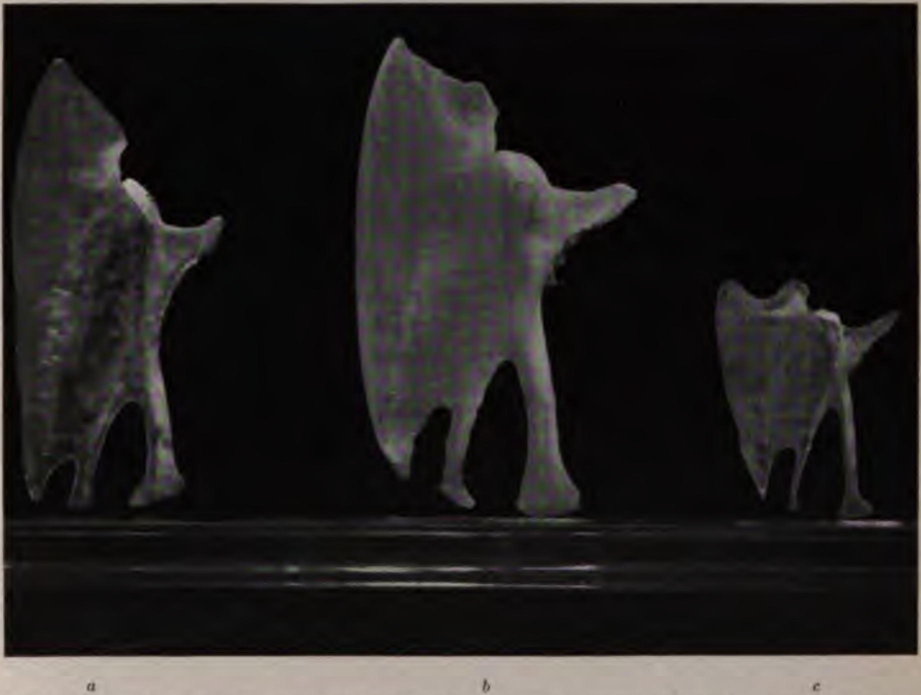
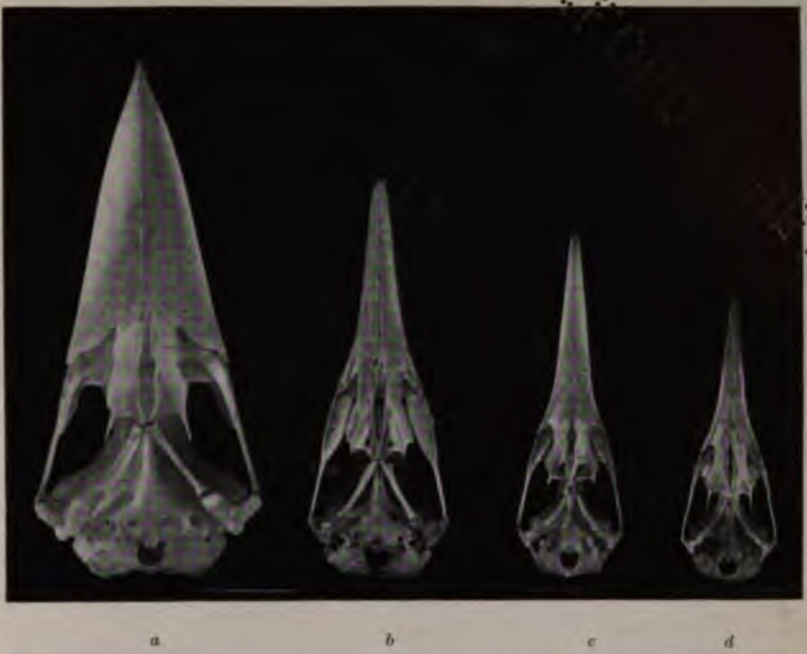


Fig. 1. Coracoids, scapulas, and clavicles of Kingfishers (slightly enlarged).

- *a.* Coracoid of Megaceryle alcyon.
- *b.* " " Dacelo gigas.
- *c.* Scapula of Megaceryle alcyon.
- *d.* " " Dacelo gigas.
- *e.* Clavicle of Megaceryle alcyon.
- *f.* " " Dacelo gigas.

Fig. 2. Sterna of Kingfishers (enlarged $\frac{1}{5}$).

- *a.* Megaceryle alcyon.
- *b.* Dacelo gigas.
- *c.* Halcyon concretus.



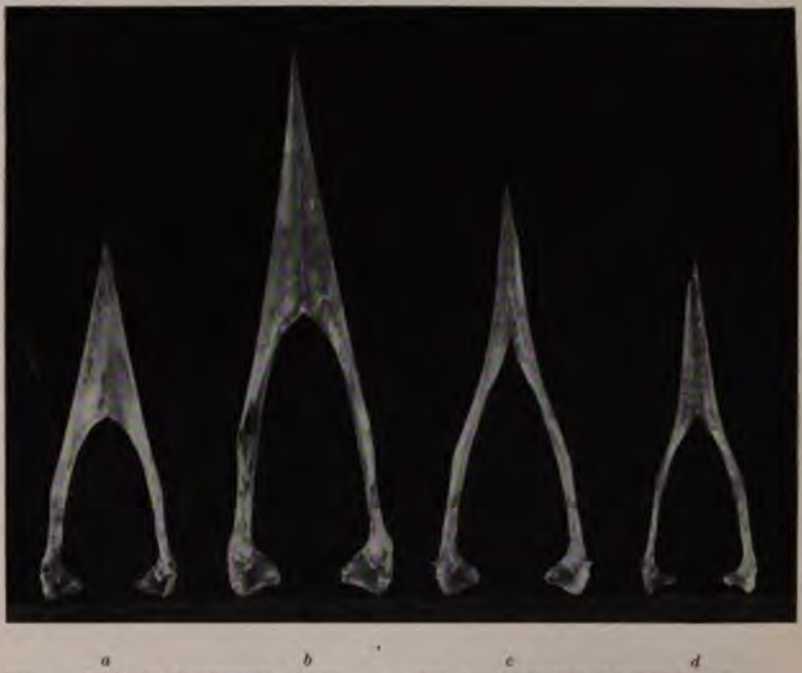
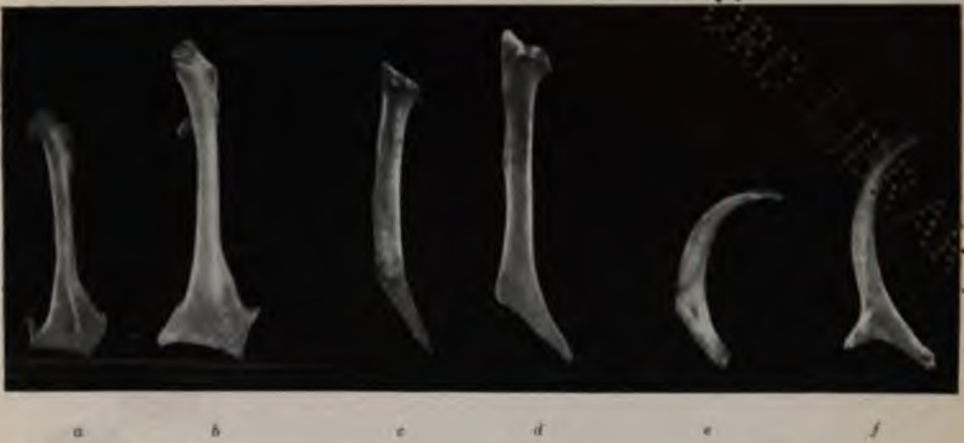


Fig. 1. Skulls of Kingfishers, palatal aspect ($\frac{2}{3}$ nat. size).

a. Dacelo gigas.
b. Megaceryle alcyon.
c. Chloroceryle americana
d. Alcedo ispida.

Fig. 2. Mandibles of Kingfishers, from below (nearly $\frac{4}{5}$ nat. size).

a. Halcyon chloris.
b. Ramphalcyon capensis.
c. Megaceryl
d. Chlorocer



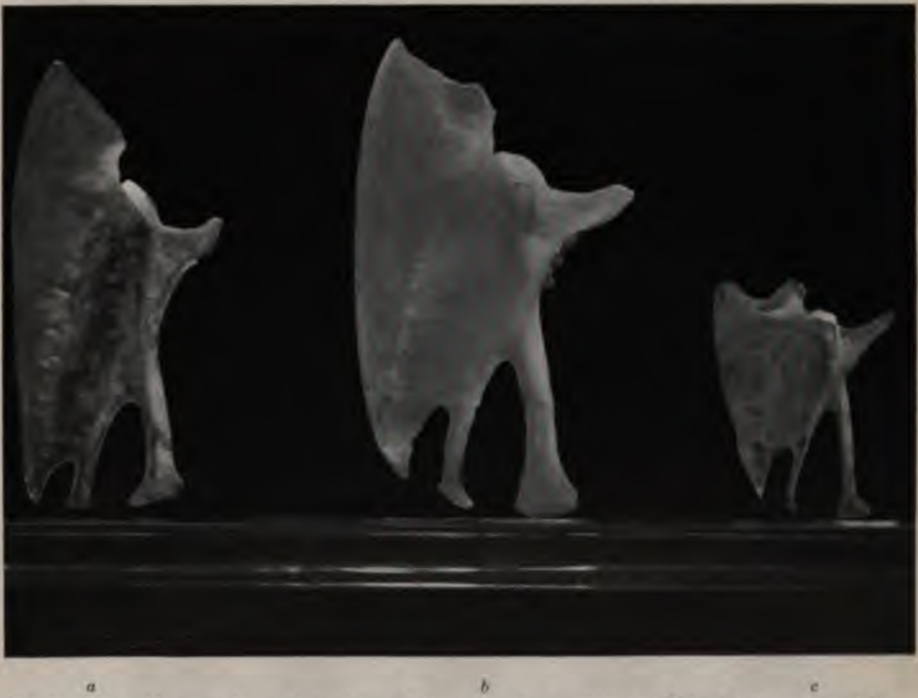


Fig. 1. Coracoids, scapulas, and clavicles of Kingfishers (slightly enlarged).

- *a.* Coracoid of Megaceryle alcyon.
- *b.* " " Dacelo gigas.
- *c.* Scapula of Megaceryle alcyon.
- *d.* " " Dacelo gigas.
- *e.* Clavicle of Megaceryle alcyon.
- *f.* " " Dacelo gigas.

Fig. 2. Sterna of Kingfishers (enlarged $\frac{1}{2}$).

- *a.* Megaceryle alcyon.
- *b.* Dacelo gigas.
- *c.* Halcyon concretus.

59.15,7

Article XXIII.— CONCEALING COLORATION, AN ANSWER TO THEODORE ROOSEVELT.[1]

By Abbott H. Thayer.

First as regards the conspicuousness of white. There is an almost universal idea that white has an intrinsic power to be conspicuous under all circumstances. This comes from the fact that it is conspicuous in the very situations to which mankind devote almost their whole attention. The materials of man's occupations lie mainly below the level of his eye. Tables, desks, tool-benches, the soil of the farm, and the haunts of most of man's game, all habituate his eyes to looking more are less *downward,* and white seen, among these things, *from a higher level,* is the brightest color.

But there are many creatures that look mainly *upward,* in the getting of their living. These are such as live right *on* the ground; toads, snakes, and field-mice, for instance, and as constantly see things against the *sky* as we see them against the *ground.*

But to return to man's view-point. Even the 'Titanic's' disaster is powerless to call attention to the truth. People all think, as Roosevelt does, that white has some intrinsic power to be seen. Here at least, where thousands of lives are at stake, it would pay for schools to work up this matter of optics. Here, as in the former case of the 'Arizona,' a ship ran into an iceberg, *because* white against the night sky (or the sky reflected in a calm sea) is at the minimum of visibility. The 'Titanic's' lookout failed to see the mountain of white ice till they were almost upon it; yet a boat-load of survivors saw from two miles away the 'Titanic's' "great bulk outlined in *black* against the starry sky" (italics mine).

This principle seems to be known in the Norfolk Broads, where they use dark sails, because white ones caused so many collisions by being hard to see at night. Will the world never begin to learn why this is? Distinguishability means *contrasting* in appearance,— as light on dark, or dark on light,— and there is the whole of it.

(In the Bulletin of the Am. Museum of Natural History, Theodore Roosevelt's attack on our book on Concealing Coloration is, without a single exception that I can recall, as wrong at every scientific point as it is possible to be. He has blindly attacked all the purely optical statements, and these are open to absolute demonstration.)

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[1] Revealing and Concealing Coloration. By Theodore Roosevelt. Bull Amer. Mus. Nat. Hist., Vol. XXX. pp. 119–231, August 23, 1911.

For my assertion that white on objects' upper slopes, under an open starry sky without the moon or any artificial light far or near, is an absolute match for the sky, Col. Roosevelt can hardly find words to express his contempt, saying many things which must some day look very funny to him when he finds out his error.

To test this sky-matching power of white, place in a wide open field, under such a sky as I have described above, any darkish colored rotund thing, like a sofa-pillow or a stuffed gunny-sack, a few feet above the ground, as a deer's body would be. Then sit down on the ground a few yards off, and look at it against the sky. It will silhouette dark and strong. While you watch it from this position, have some one cover all of it that sticks up above the horizon with a smooth white cloth. The whole white expanse will vanish into the sky, so that you can hardly believe the pillow is not cut off. For another example, try in the same way an imitation skunk (you can make him out of a stuffed black stocking, with a white patch pinned onto his crown, and a white streak down his nose) out in the same field at night with no light but star-light. Lie down nose to nose with him, so that you seen his white against the sky, and you will see how the real skunk's white shears off his top, passing it off for the sky, to the sight of mice and turf insects as he gobbles them up.

Now as to Roosevelt's scoff at the idea that a zebra's white stripes reduce his distinguishability: The accompanying photographs are a total answer.

It only remains to show that this is the view a lion gets *when he is near enough to be dangerous;* and it is this danger-or-difficulty-moment that costumes in general prove to fit. Safe out on the veldt the zebra may or may not happen to show against the watching lion's sky, according to the *relative level* of the two animals, but when the lion is dangerously near he and the zebra are nearly on one level. Take a staff that will stand up a little over four feet when you stick it into the ground. This represents a zebra's shoulder-height. Set it up, out of doors, in a score of situations in both level and hilly country, sitting down within a lion's spring of it (say ten or fifteen feet) and looking at it from the height of a lion's eyes (anywhere from three feet down to his crouching height of one foot) and you will see its top practically *always against the sky.* The only exception will be a view *down on it* from a *very steep* hill-side, or, of course, toward a *very near* cliff.

And it is n't that the lion can't see a moving zebra, but, at a reedy drinking-place such a costume as the zebra's throws all possible difficulties in the lion's way; since so perfect a counterfeit of sky and reeds must cause the lion the greatest proportion of failures to *notice* the zebra when he is still, or to keep his *outline* in sight as he bounds away.

To prove that these sky counterfeits work still better, if possible, in the woods, try your gunny-sack deer and your skunk there, looking at them still from the lower level as before. You will see that their whites insist upon passing either for light vistas in the forest top, or for actual sky glimpses, according to how much light they get. Also in the woods they constantly help the animal not to silhouette dark when he is in shadow against light ground. In the woods, especially, any kind of night will *do*.

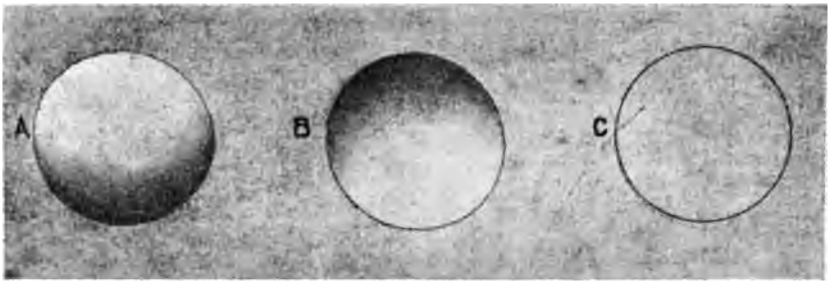

Fig. 1. Under the sky's light, a one-colored globe looks like the drawing on the left. If it is colored after the style of the one in the middle the effects cancel each other and the result is the drawing on the right.

Next, take what Roosevelt says of countershading which, after the sixteen years since I published it he has never grasped at all. He writes me: "So about countershading. Unquestionably under certain conditions of life, an object colored black or very dark above and white below disappears from view. But when you come practically to apply this, and put a man in a black frock coat and a pair of white duck trousers, you will find that under ordinary conditions you have not by this species of countershading made him invisible, you have on the contrary made him extremely conspicuous under ordinary conditions." The word countershading is an exact description of the real principle. It has to do, as my diagram shows, solely with the chiaroscuro-law of ROTUND objects — the law that these show lightest on the side *toward* the light and vice versa — and countershading serves to cancel this aspect. What has the coloring of a man's trousers, *all in the one vertical plane of his erect body,* to do with this wonderful law. Could there be a completer failure to grasp a principle?

Roosevelt also says that its part in the concealment of the higher animal forms is "negligible"; and especially that when an animal is graded from *very* dark above to white below he is not countershaded, and wears a *revealing* coloration.

Take three pairs of decoys, made of woolen, stuffed like a rag-doll, and each mounted on a wire pedestal firmly stitched to its back side. Get an artist (or try yourself) to color these as follows. Set one pair of them on very light colored beach sand (or some imitation of such a ground), and color them with pastel *all over* with the exact tone of this light ground (oil colors on the upper side would be too shiny). In spite of wearing absolutely the color of the ground, if they are six inches long they will be visible a quarter of a mile away. Then have your artist change the color of one of them, until, at a distance of five or six yards, it is almost or quite effaced. He will do this by grading it lighter and lighter from the back down to the belly in a color-gradation from sand color above to cold white below. Do the same thing to one of your other pairs, on a *medium* colored ground, the road or the bare earth of a garden, covering one *all over* as before with the very tone of the soil it stands on, and effacing the other. Do also the same thing to the third pair on some very *dark* soil or burnt over patch. In every case, choose, to increase the severity of the test, as smooth and bare a place as possible.

You will find that while in each case the countershaded one, in order to vanish, has to have the *top* median line even a little *darker* than the ground it stands on, the *bottoms* of every one of them, even of the black one, have to be done with *purest* white oil paint (tube colors). Nothing less white overcomes the shadow at that point.

By these operations you will find yourself producing delicate sand-colored plovers on the pale sand and, on the darker ground, birds like many darker species that haunt this middle colored ground; while on the *black* earth you will evolve a beautiful imitation of some bird like the purple sandpiper or the common oystercatcher: and you will see how wrong is all that Mr. Roosevelt says on the subject.

In open land this necessarily pure white belly is constantly subject to the temporary revealing tendency of the sky's shifting luminosity, which, owing to moving clouds, repeatedly shines, now for a few minutes *too far down the gradation*, making it for the moment too bright, or else not far enough, making it show too dark, *though always magical in its ghostliness compared to the monochrome one.* However, when the shifting light *does* slightly reveal the under white, the animal's aspect is merely a *caricature* of non-existence: the brightest possible stripe of white in this, so to speak, wrong relation to the animal's body, refusing to give away the animal. The idea that it reveals him is purely theoretic. It does serve for *identification*, and for keeping him in view, *after* detection. I have repeatedly proved this upon my spectators, and learned that one of these *caricatures*, with both its dark top and white belly lighted so as to *show*, is still wholly deceptive, passing merely for a dark mark and a light one *on the ground beyond.* Stilts and oyster-catchers, being done merely in two tones - black above and white below — even commonly show this white along its *upper* edge where the sharp black of the wing cuts it. Roosevelt and the naturalists wholly confound *detection* with *identification after* detection. In fact this is their main difficulty.

As to Roosevelt's saying that the white belly of the white tailed deer is conspicuous in the woods where he lives, the truth is the contrary. In extensive woods side illumination is absent: the light comes straight *down;* and there an animal's belly is forever in the dark. If you can't watch wild or tame deer in such a wood, take your medium colored decoy in there, and hang it, at the height of a deer, exactly plumb, on one twig after another, and look at it from a few yards away, and you will begin to know that Roosevelt is absolutely wrong in this matter. You will find that the brightest that the pure white belly can there show only suffices to cause it *entirely to vanish* by absolutely matching its background. (Of course you may detect it now and then against an extra black trunk or shadow spot.)

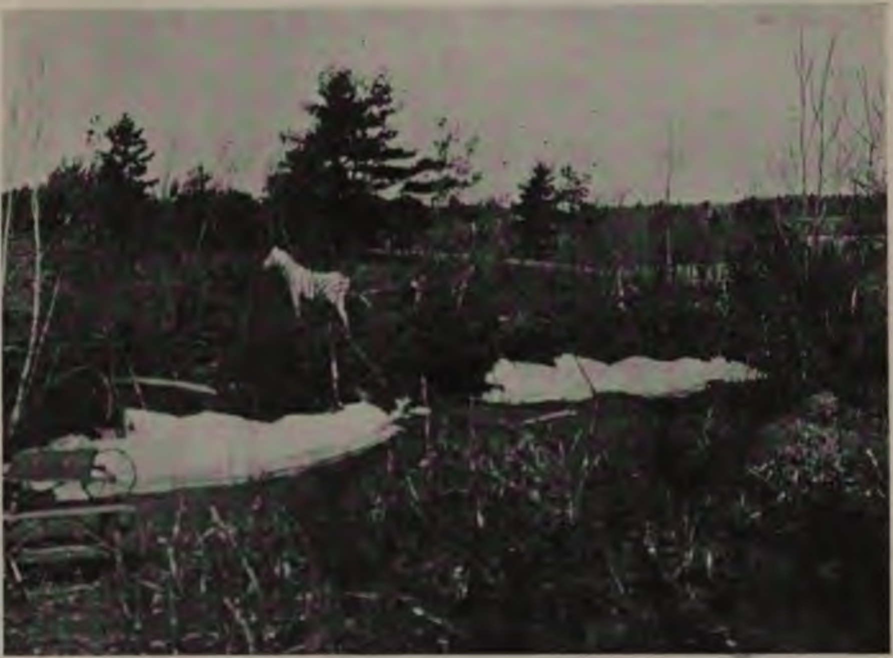

Fig. 2. Zebra and Ass from the average viewpoint of a man. The Zebra conspicuous, the Ass inconspicuous. A man averages *above* a zebra's level. The Zebra conspicuous because seen against tthe ground, the Ass for the same reason *in*conspicuous.

Now read Roosevelt's whole dissertation on countershading, and turn again to your six decoys all in place on their respective soils. The three that are colored all over exactly like the soil they stand on you can see from afar. If they are six inches long you can see them a quarter of a mile away. The three countershaded ones, if well painted, are totally invisible at five or six yards, and ghostly at two yards. You will see that the dark ground one, with its black top and purest white belly, is just as perfect on its particular soil as the pale topped one on *its* soil; and that for vanishing, the most necessary thing of all, in all your cases, is the *perfection of the pure white* below.

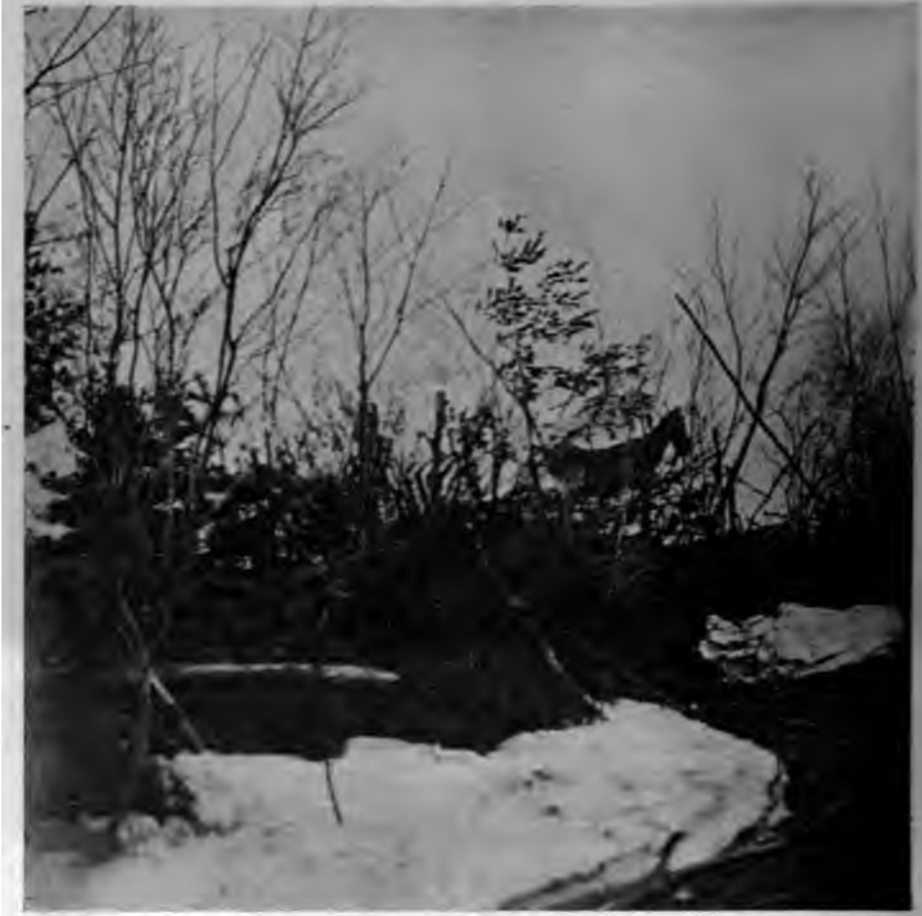

Fig. 3. Zebra and Ass from viewpoint of a near, stalking lion. The Zebra inconspicuous, the Ass conspicuous. The lion looks from a *lower* viewpoint than the Zebra.

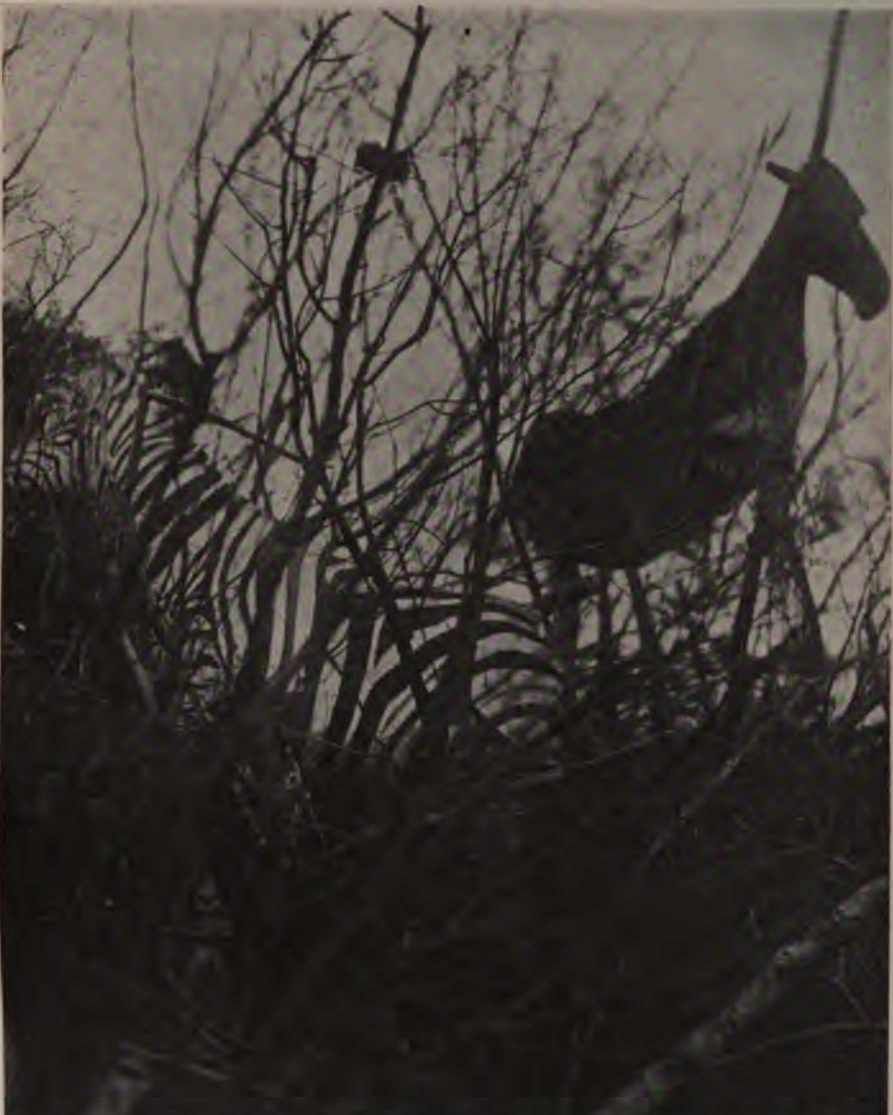

Fig. 4. Artificial Zebra and Ass from viewpoint of a near, stalking lion, viz., a *lower* level. The Zebra concealed; the Ass revealed.

(To judge from my own success in discovering why one or another species does not wear the colors one would expect him to, I feel confident that in Africa I could soon discover in the habits of hartebeests and gnus why they were neither countershaded nor white-topped, *i. e.*, why they approach the small class of the buffaloes and pachyderms that have no color arrangement at all. The first task, however, is to show the optical effect of these color-schemes, where they are found.)

In the United States this countershading is the color-scheme of all but about twenty of our birds and mammals together, and if Roosevelt could suddenly see them bereft of it, he would see them pass at one bound from the average aspect of your *invisible* three to your quarter-of-a-mile-away *visible* ones!

You will perceive that since your effaced models can stand there invisible not six yards away on bare land, that the place might be *covered* with similarly colored ones, or, just as well, with similarly colored *live* birds or mammals of any kind, and you be none the wiser; and that what Mr. Roosevelt says about countershading failing on a bare plain merely shows his extraordinary ignorance both of its universal operation, and power, and even apparently of many phases of animal life. Many men are well aware that a salt mud flat may be *covered with unseen waders*, so that unless you watch it an hour, or flush them all by a gun-shot, you often fail to detect the main numbers. It is the same on the beach, the same on the sea with the gulls, and how much more on the forest floor where no *side light* can interrupt! Try all this.

The idea that one of these white-bellied creatures crouches to *conceal his white* becomes rather a joke to those who have discovered that purest white at that point *is the concealer*. What crouching does is to reduce their inevitable risk from momentary silhouetting, now light, now dark.

I shall be happy to show to any one coming to Monadnock the equally demonstrable *falsity of every other optical statement in Roosevelt's writings.*

Naturalists seem unable to see that this subject is pure optics. This has cost them all their mistakes. Optics discovers that each of these animals' costumes is a perfect generalization of one of the animal's typical backgrounds. Instead of inferring from this optical fact that *many thus costumed individuals of the animal kingdom must often escape one's sight*, the unthinking scoff at it, and for all argument merely tell how many creatures they *have seen*. This is like denying that woodchucks go into burrows, because you have often seen them sitting up in the clover, or that your neighbor ever steals, because you have often seen him not stealing.

The zebra and ass pictures in this article serve to point out how entirely conspicuousness and inconspicuousness depend on the point of view, and show how necessary it is to investigate each animal's habits in their possible relation to this point of view. They point out, too, how entirely conspicuous in many familiar viewpoints an animal may be, while at the same time he is the most concealed of animals the moment you look at him from the situation of his most dangerous enemy.

Cryptic coloration, then, is only the imitation of the immediate or the typical background.

An animal seen from a level above his own has the dark earth for background, while, at the very same moment, seen from two or three feet lower down he has the *bright sky* instead, or is, at least, seen in the direction in which sky or glimpses of sky are to be expected. The moment this is understood, it becomes obvious that there is no such thing as a cryptic coloration *per se,* and that any amount of *conspicuousness from all other viewpoints* has nothing whatsoever to do with the question. The thing to be expected, then, was that all species in any way dependent on not being seen (or not being *well* seen) by some other species will prove to wear an imitation of the background against which that species would see them. And it would be expected that this imitation would be unmixed with other background-imitation in proportion to how much more important it was for the wearer to escape those particular eyes than to escape those of less dangerous and differently situated foes; and whenever naturalists will go through the tremendous study that this field requires they will discover that this is the very case. They will discover a perfectly astounding correspondence, throughout the animal kingdom, of the cryptic effect of each costume, however gorgeous and elsewhere conspicuous, with the background against which the wearer's most dangerous foe or his most necessary quarry sees him. This correspondence is so unintermitting throughout class after class and order after order (and everywhere so exact as to be only appreciable by colorists), that the naturalists' present idea that it is accident is simply a joke. The number and the perfection of the cases *are* the evidence, and no naturalist has yet even attempted to acquaint himself with either of these things, though some of them may suppose that they have, till they witness what I have to show.

Monadnock, N. H.,
August 29, 1912.

59.57 (72.2)

Article XXIV.—LIST OF INSECTS COLLECTED BY THE "ALBATROSS" EXPEDITION IN LOWER CALIFORNIA IN 1911, WITH DESCRIPTION OF A NEW SPECIES OF WASP.[1]

By John A. Grossbeck.

(By Permission of the U. S. Commissioner of Fisheries.)

The material listed below was secured by Dr. Chas. H. Townsend in Lower California while in command of the 'Albatross' Expedition (1911), and was collected in the Cape Region between San José del Cabo and Triunfo, near sea level.

Some of the species were determined from the collections in the American Museum of Natural History, but all such determinations were verified by specialists who also identified the remainder of the material.

Mr. A. N. Caudell of the United States National Museum, Washington, D. C., is responsible for the determinations in the Orthoptera; Mr. S. A. Rohwer of the United States Department of Agriculture, Washington, D. C., is similarly responsible for those in the Hymenoptera; Mr. H. G. Barber of Roselle, N. J., has determined or verified the Hemiptera, and Messrs. Leng and Beyer of New York City have likewise determined or verified all the Coleoptera. To these gentlemen, as well as to Dr. L. O. Howard, Chief of the Bureau of Entomology at Washington, through whom Messrs. Caudell and Rohwer made their determinations, the compiler of this list expresses his sincere thanks.

List of Species.

ORTHOPTERA.

Periplaneta americana Linn.	40	specimens
Pycnoscelus surinamensis Linn.	26	"
Gryllus mexicanus Sauss.	8	"
Gryllus galapageius Scudd.	1	"
Gryllodes sigillatus Walk.	3	"
Trimerotropis vinculata Scudd.	16	"
Heliastus aridus Bruner	2	"

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[1] Scientific Results of the Expedition to the Gulf of California in Charge of C. H. Townsend, by the U. S. Fisheries Steamship 'Albatross,' Commander G. H. Burrage, U. S. N., Commanding.

Schistocerca vaga Scudd.	3	specimens
Schistocerca maya Scudd.	1	"
Melanoplus complanatipes Scudd.	1	"

HEMIPTERA.

Deinostoma dilatatum Say	23	specimens
Ambrysus parvulus Mont.?	20	"
Conorhinus maximus Uhl.	1	"
Lygaeus reclivatus Say	13	"
Oncopeltus gutta H. S.	5	"
Oncopeltus fasciata Dall.	3	"
Oncoplatus varicolor Fabr. var.?	15	"
Largus cinctus H. S.	9	"
Leptoglossus zonatus Dall.	1	"
Pachylis gigas Burm.	37	"
Mozena lurida Dall.	2	"
Loxa flavicollis Dru.	2	"
Brochymena obscura H. S.	1	"
Pachycoris torridus Scop.	58	"

COLEOPTERA.

Tetracha carolina Linn.	21	specimens
Calosoma palmeri Horn	3	"
Plochionus timidus Hald.	1	"
Anisodactylus piceus Men.	29	"
Rhantus anisonychus Cr.?	1	"
Thermonectes marmoratus Hope	2	"
Megadytes fraternus Sharp	1	"
Hydrophilus insularis Lap.	2	"
Hydrophilus californicus Lec.	14	"
Coccinella sanguinea Linn.	1	"
Dermestes vulpinus Fabr.	22	"
Chalcolepidius rubripennis Lec.	10	"
Dicrepidius corvinus Caud.	2	"
Ludius texanus Lec.	1	"
Chrysobothris merkelii Horn?	1	"
Acmæodera flavomarginata Gray	1	"
Sitodrepa panicea Linn.	14	"
Amphicerus punctipennis Lec.	4	"
Dinoderus truncatus Horn	6	"
Polycaon punctatus Lec.	1	"
Atænius strigatus Say.	1	"
Lacnosterna nitida Lec.	1	"
Pelidnota lucæ Lec.?	1	"
Cyclocephala dimidiata Burm.	7	"
Ligyrus gibbosus De G.	12	"
Ligyrus sp. near *gibbosus*	1	"
Megasoma thersites Lec.	37	"

Derobrachus forreri Bates	6	specimens
Eburia ulkei Bland	2	“
Dendrobius mandibularis Serv.	32	“
Lisonotus multifasciatus Dup.	22	“ [1]
Stenaspis solitaria Say	31	“
Tragidion simulatum Lec.	1	“
Stenosphenus novatus Horn	23	“
Cyllene antennatus White	2	“
Acanthoderus peninsularis Horn	1	“
Lagochirus obsoletus Thom.	1	“
Metacycla insolita Lec.	22	“
Triorophus subpubescens Lec.?	1	“
Zabrotes pectoralis Sharp	22	“
Emmenastus erosus Horn	13	“
Centrioptera spiculifera Lec.	8	“
Centrioptera angularis Horn	1	“
Asida ægrota Lec.	1	“
Asida connivens Lec.	1	“
Asida confluens Lec.	10	“
Coniontus subpubescens Lec.	26	“
Eusattus lævis Lec.	26	“
Cerenopus concolor Lec.	6	“
Eleodes eschscholtzii lucæ Lec.	25	“
Blapstinus sulcatus Lec.?	28	“
Tribolium ferrugineum Fabr.	28	“
Cactophagus validus Lec.	1	“
Calandra orzæ Linn.	23	“

HYMENOPTERA.

Dasymutilla gloriosa Sauss.	24	specimens
Dasymutilla sp.	4	“
Elis sp. near *hamatus* Say	3	“
Elis sp.	4	“
Campsomeris dorsata Fabr.	2	“
Pepsis "formosa" Say	16	“
Pepsis sp.	1	“
Psammochares sp.	1	“
Arachnophroctonus ferrugineus unicolor Vier.	1	“
Chalybion californicum Sauss.	1	“
Sphex sp. near *femur-rubra* Fox	1	“
Eucerceris angulata Rohwer, new species	1	“
Microbembex monodonta Say	2	“
Notogonia sp.	1	“
Polistes sp.	21	“
Xylocopa sp.	22	“

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[1] Two of the specimens from this lot were of the jet black variety.

Eucerceris angulata *Rohwer*, new species.

Judging from the description the following new species is related to *Eucerceris punctifrons* (Cameron), described as an *Aphilanthops*, but the clypeus does not project outwardly, the relation of the ocelli with the eyes and each other is different, and the color is somewhat different. In some respects *Eucerceris chapmanæ* Viereck and Cockerell, seems to be related to this species, but the description of *chapmanæ* does not fit the present insect in all ways.

Female. Length 11 mm. Clypeus flat, median portion with a short, flat, truncate process which narrows apically and is on the same plane as the face; nasal eye margins distinctly diverging beneath; facial quadrangle much broader beneath than high; frontal carina uniform in width, not impressed; mandibles of the narrow type; antennae rather short, the third joint much shorter than the two following; postocella line somewhat shorter than the ocelloccipital line and much shorter than the ocellocular line, neither of the latter are equal with the third and fourth antennal joints as in *punctifrons;* lateral anterior angles of pronotum obtusely, distinctly dentate; propodeal enclosure punctured similar to the propodeum, with the usual longitudinal sulcus; entire insect closely, rather coarsely, distinctly punctured; abdomen normal, pygidium about two and a half times as long as broad, rounded apically, broader basally, hypopygidium with a very deep U-shaped notch. Black: spot on median part of clypeus, frontal cariba, large spot on sides of face, spot on superior orbits, line on pronotum, metanotum, angles of propodeum, bands of first to sixth dorsal segments, uniform in width on first, narrowed in middle on following and interrupted on four and five, yellow; legs black, four anterior tibæ beneath pale, tegulæ black, piceous, and yellow, wings subhyaline, radial and subcostal cells fuscous; costa and stigma reddish-yellow, rest of venation dark brown, pubescence sparse, silvery.

Lower California, between San José del Cabo and Triunfo. One female collected by 'Albatross' Expedition, 1911.

Type: American Museum of Natural History.

59.7.31P13.3

Article XXV.—NOTE ON AN EMBRYO OF *PRISTIS CUSPIDATUS.*

By L. Hussakof.

Embryos of *Pristis* are exceedingly rare, and until recently very little was known regarding their appearance, structure or the size they attain by the time of birth. Bloch,[1] in 1786, published a colored figure of an embryo with a yolk sac, and referred to it briefly in a few lines. But this figure is rather poor, it shows no details, and the sword is erroneously represented with teeth in its anterior third, despite the statement in the text that "das Schwerdt ist noch weich, und die Zähne liegen in der Haut verborgen." Owen,[2] in 1846, briefly described an embryo in the Hunterian collection, in the following words: It is "eight inches in length, including the saw, and has the duct of the external vitellicle [yolk stalk] attached." These appear to be the only descriptions of sawfish embryos that have been published until recently. Günther,[3] in 1870, mentioned several embryos of *Pristis pectinatus* in the British Museum collections, but gave no description nor any data respecting them.

In view of this paucity of information regarding sawfish embryos, special interest attaches to a short paper published by Dr. T. Southwell,[4] in 1910, in which he briefly describes an embryo of *Pristis cuspidatus* Latham. This was one of a brood of twenty-three taken from a female sawfish 15½ feet long, which was caught on the coast of Ceylon. Through the kindness of Dr. Southwell, the American Museum has received as a gift three of these embryos (No. 3268, American Museum). And inasmuch as his description appeared in a Ceylonese journal and will probably escape the attention of many ichthyologists who would be interested in these embryos, it seems advisable to redescribe one of them briefly, and to give a good figure of it.[5]

The embryo (Figs. 1 and 2) of *Pristis cuspidatus* here described, is 355 mm. in total length. It closely resembles the full-grown sawfish, except (1), for the presence of a large yolk sac which is attached by a yolk stalk; and (2), the circumstance that the teeth of the saw have not yet cut through the membrane enveloping them.

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[1] Naturgeschichte der ausländischen Fische. Berlin. 8°. Erster Theil, 1786, p. 56, and pl. 120.

[2] Lectures on the comparative anatomy and physiology of the vertebrate animals. Part I.— Fishes. London, 1846 8°. p. 301.

[3] Catalogue of fishes in the British Museum of Natural History, VIII, p. 438.

[4] A descriptive note on the capture of a large sawfish (*Pristis cuspidatus*) containing intra-uterine embryos. Spolia Zeylanica, VI, 1910, pp. 137–139, 1 pl.

[5] Dr. Southwell's paper was illustrated by a plate giving two photograph embryo; but the photographs do not show all the characters clearly.

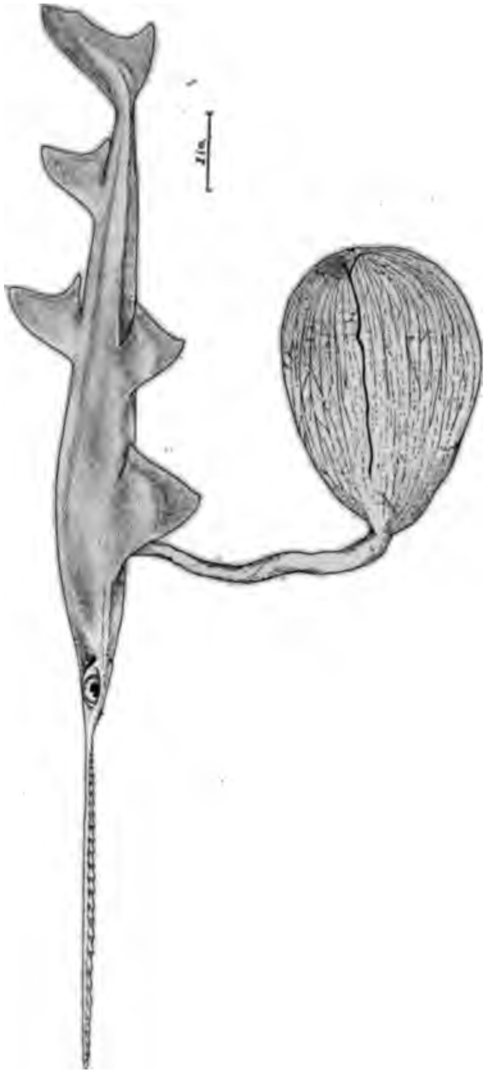

Fig. 1. Embryo of *Pristis cuspidatus* Latham. × ⅓. No. 3268 American Museum.

The yolk sac is very large (95 mm. in length), somewhat pear-shaped, and attached by its smaller end to the stalk. A cross-section at its middle (Fig. 2, *a*) is elliptical, with axes 72 mm. and 55 mm. respectively. The stalk is 11 cm. long; widest at its juncture with the sac, where it is 8 mm. in diameter, and gradually decreasing to 4 mm. at its point of insertion in the ventral wall of the embryo, midway between the gills. A dark blood vessel, probably the vitelline artery, stands out clearly on the surface of the sac, and a network of very delicate vessels is also to be seen. The color o

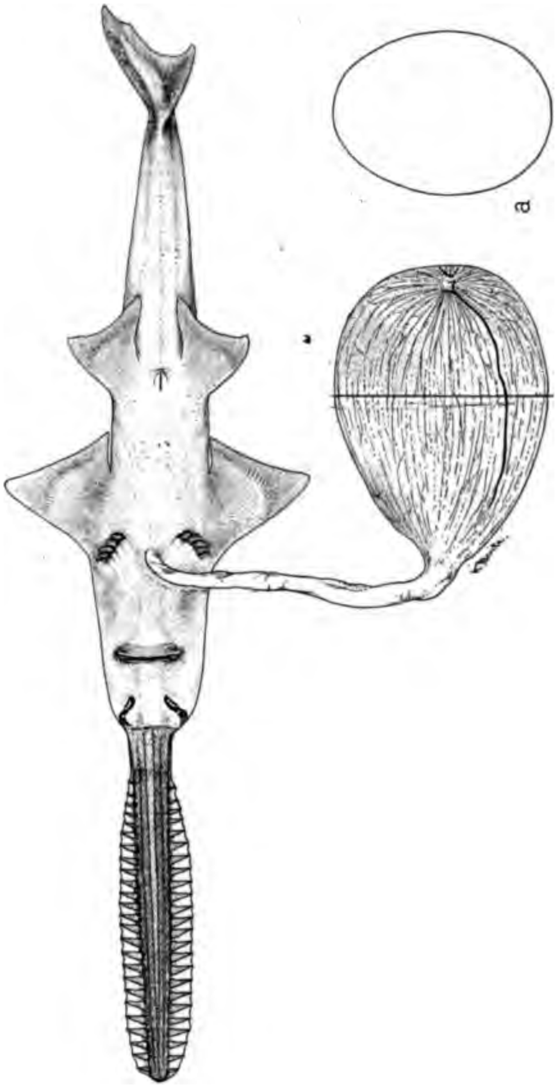

Fig. 2. Same embryo as in Figure 1, in ventral view; *a*, cross-section of yolk sac in plane indicated by the line. The saw is represented as it appears when held to the light.

sac when fresh, according to Dr. Southwell, is that of the yolk of a hen's egg.[1]

The saw is 117 mm. long and still flexible. The teeth are completely enveloped in membrane, their points forming a series of crenulations at the margins of the rostrum. On holding the saw to the light they can be clearly seen; they are yellowish, sharply pointed, and average 6 mm. in length. In the specimen figured there are 25 teeth on the left side and 24 on the right. They are not arranged strictly opposite one another in pairs. The toothless basal portion of the saw measures 22 mm., or about one-sixth of the entire saw.

The embryo has all openings to the exterior—gills, spiracles and pores—completely formed, as was noted by Southwell. A lateral line is present; it extends along the side as far back as the caudal. There is a row of fine pores arranged in a horizontal line, extending from a point below the eye to near the origin of the pectoral fin. The eyes are completely formed, large and protruding.

Respecting the disposal of the embryos in the mother fish, Dr. Southwell says: "The embryos all lay horizontally, *i. e.*, parallel to the axis of the parent. There still remained a small quantity of a serous fluid in the oviduct, the bulk of which had probably been lost prior to examination.... Some embryos lay with the rostrum close to the cloacal opening, whilst others were exactly opposite."[2]

Measurements of an Embryo of Pristis cuspidatus.

Length (tip of saw to end of caudal)	355	mm.
Width across pectorals	95	"
Length of saw (from line of junction with head)	117	"
Greatest width of saw	24	"
Length of proximal untoothed portion of saw	22	"
Average length of rostral teeth	6	"
Base of saw to origin of first dorsal	113	"
Origin of first dorsal to origin of second	50	"
Width of head (in region of eyes)	31	"
Length of yolk sac	95	"
Greater diameter of yolk sac	72	"
Lesser diameter of yolk sac	55	"
Length of yolk stalk	110	"
Greatest diameter of yolk stalk	8	"

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[1] In the two other embryos in the American Museum, the yolk sacs have been removed, and only the stalks remain.

[2] Southwell, *loc. cit.*, p. 139.

59.57,53m:13.41

Article XXVI.—OBSERVATIONS ON SOME NORTH AMERICAN MEMBRACIDÆ IN THEIR LAST NYMPHAL STAGES.

By Ignaz Matausch.

Plate XXVII–XXXII.

The material described in the present paper was collected at Newark, Montclair, and Elizabeth, N. J., in the year 1910, with the exception of the insects of Figs. 1, 11, and 17, as otherwise noted. I succeeded in rearing all of the forms.

Ceresa *Am. et Serv.* **albescens** *Van D.*

Plate XXVII, Fig. 1.

Size about 7 mm., of a whitish-yellow color and fuzzy appearance. I did not find any in 1910; the figure represents an insect collected on July 13 of last year. It seems to be a rather scarce insect for it is not mentioned in the report of the insects of New Jersey, 1909.

Ceresa bubalus *Fabr.*

Plate XXVII, Fig. 2.

Size about 8 mm., of a more or less dull greenish-brown. While collecting near Elizabeth last year I found the first nymph of this species in a thicket of *Viburnum, Sambucus,* and *Solidago,* so that I was unable to make out with which plant it was associated. On July 21 I found another and on the following day two more insects. The latter died on July 25, but the former was kept alive until August 19, when it died like the others without coming to maturity. The fact that the insect remaining alive selected *Sambucus* as a food plant, and its rather dark brown coloring led me to believe that it was the nymph of *Ceresa diceros* which is usually found in the adult stage on *Sambucus;* but while collecting near Newark on July 31, I found one nymph near an adult insect of *Ceresa diceros* on *Robinia.* Hence I was convinced it was the nymph of the species mentioned and was quite surprised when it matured, on August 11, without showing the dark brown color for which I vainly waited; it proved to be a female of *Ceresa bubalus.*

Ceresa taurina *Fitch.*

Plate XXVIII, Fig. 3.

Size 7½ mm., sometimes of a very bright green color. On July 1 of this season while collecting near Newark, I found two nymphs of a large size on *Sambucus* fully surrounded by very high plants of *Solidago;* and on July 5, three more were found near Elizabeth. The former became mature females on July 6, while of the latter only one adult male appeared on July 7.

Ceresa palmeri *Van D.*

Plate XXVIII, Fig. 4.

Size 6½ mm., of a light green color. The first nymphs were found on *Liquidambar* near Elizabeth on June 4 and 5. Additional specimens were collected on the 12th of the same month, the first of which matured on July 5. I found this species very abundant but less so than in the previous year. In its earlier nymphal stages it displays peculiar thorn-like prominences which are characteristic of this genus. This insect also has been found probably for the first time in the State, because in spite of its abundance it has not yet received mention in the report of insects of New Jersey.

Acutalis *Fairm.* **semicrema** *Say.*

Plate XXXVIII, Fig. 5.

Size 5½ mm. of a light yellowish-green; on July 5 a single nymph which became a mature female on July 8 was found under similar circumstances as the previous year namely, on *Solidago* occurring under *Sambucus.* In breeding this species I have obtained so far only females, but I am quite certain that the *Acutalis tartarea* of Say is the male of this form; and I am inclined to believe that the male described by Van Duzee is probably the variation of the same. This, however, needs to be confirmed by further observation. In the New Jersey list only the male was mentioned and the female is stated as "not yet actually taken."

Carynota *Fitch* **mera** *Say.*

Plate XXVII, Fig. 6.

Size 7½ mm., of a light or dark brown color marbelled with gray. The specimens were found near Newark on *Juglans.* A single specimen taken on May 22, I could not rear; later this species was found in large numbers, but owing to the difficulty in rearing, I selected in collecting on June 18, 19 and 26, only larger specimens of which three matured on July 2; one of these was a male and the other two were females.

Thelia *Am. et Serv.* **bimaculata** *Fabr.*

Plate XXIX, Fig. 7.

Size 8½ mm., varying in color between light and dark brown marbelled with yellow or gray. I vainly tried two years ago to bring some of these insects to maturity. This season I found them in great numbers near Newark on *Robinia pseudacacia* and in both adult and nymphal stages; several of the latter were taken for experimentation and on July 4, three adult females developed. It was on this occasion for the first time that I found ants among them in abundance. Whereupon I am inclined to believe that the ants care for them only when they occur in large numbers.

Telamona *Fitch* (species not determined).

Plate XXIX, Fig. 8.

Size 8½ mm., found together with adult insects on *Liquidambar* near Elizabeth. Last year I vainly tried to bring this form to maturity; in one specimen the skin of the nymph split, but the insect died without developing further. On August 14 of this season while collecting at the same spot I finally obtained one female still fresh and soft after emergence together with the recently shed skin of the nymph; hence all doubts concerning the relationship were removed.

Telamona barbata *Van D.*

Plate XXIX, Fig. 9.

Size 7 mm., of a dark grayish brown color. The only nymph of this small and rather hairy species I found on *Quercus* near Newark on July 1; it became a mature male on the 5th of the same month. This insect also seems to be scarce, as it is not mentioned in the report on the insects of New Jersey.

Telamona unicolor *Fitch.*

Plate XXX, Fig. 10.

Size 7½ mm., of the same color and appearance as *Carynota mera* (Plate XXVII, Fig. 6). From a collection of *Carynota* nymphs taken on *Juglans* and believed to be all of the same species I was greatly surprised to obtain on June 15, a nymph collected ten days earlier which became a male *Telamona* of a species unknown to me. On the 19th I obtained another male and on the 21st two additional males and one female; the latter is an entirely different color from that of the male, being a clear green especially immediately after maturity. Later the individuals of this sex become yellowish-green while the males have a prothorax of a purplish green-yellow with dark brown markings.

Cyrtolobus *Godg.* (species not yet determined).

Plate XXX, Fig. 11.

Size 4½ mm., of a greenish-brown color. The specimen was found on *Quercus*, the first insect taken on a collecting trip in New Jersey on May 30, 1908; in addition one adult insect was taken but was later lost. On June 6 of the same year in the Bronx, New York, I found on the same plant two more nymphs which were quite similar to the above mentioned specimens as regards structure and color but were somewhat smaller in size; one developed the next morning, but the other from which the figure was made died. In 1910 I obtained nymphs of this genus as early as May 15 while collecting with Prof. A. Petrunkevitch at Montclair, N. J., where we found three different species on *Quercus*. One of these was rather small, green in color, and densely haired; this specimen escaped. The second which died was a very brilliant green and red and possessed a very long anal tube. The third which was the largest of the three, developed into an adult female on May 26; its abdominal prominences were more strongly developed than in the case of the nymph next described and differed also as an adult, but in my opinion it is probably a variant and not a distinct species.

Cyrtolobus sp.

Plate XXX, Fig. 12.

Size 5½ mm., of a green and red-brown color. On June 4 or 5 I found a nymph of this form in addition to three adult insects, all males, on the same oak tree at Elizabeth, from which during the previous year only females were taken. It was the only nymph that could be discovered and was doubtless of the same species as the adults. Similar insects had been found on *Quercus* at Newark, which varied only slightly in so far as prominences were somewhat thinner. The adults had the same colors and pattern with the dark marking on apex of prothorax a little larger. The first insects were found on May 22 and although most of them died, the members of a series collected on May 29 and 30, with very few exceptions, matured on May 30 to 31, giving both sexes. The figure represents the specimen collected at Elizabeth which is between the nymph from Montclair and the nymph from Newark.

Cyrtolobus sp.

Plate XXXI, Fig. 13.

The figure represents a specimen of another species of *Cyrtolobus* which is larger than the foregoing to the extent of 6 mm. This I collected at the same time as the former on the same plant at Newark. The insect differs as regards the abdominal prominences; the entire body is densely hairy and is lighter in color. The specimens were fewer in number but none the less I obtained both sexes on May 30 to 31.

Cyrtolobus (*Atymna* Stål) **querci** *Fitch.*

Plate XXXI, Fig. 14.

Size 6 mm., of a vivid light green color. These were collected at Newark on May 22 with the foregoing specimens and were found on *quercus.* The first two specimens had died on the 25th, while the other became mature females on May 26. I intended to keep the latter until this green color became fixed, but it escaped during feeding. More were collected on May 30 and 31, all of which matured producing three females and five males. This insect stands in the list of the insects of New Jersey as "not yet found in the State"; hence this is the first record of its occurrence.

Ophiderma *Fairm.* (not determined).

Plate XXXI, Fig. 15.

Size 5½ mm., of a green and brown color. Only a single nymph was found among the specimens of *Cyrtolobus* on *Quercus* on May 30, at Newark; this specimen matured the next day as a female.

Vanduzea *Godg.* **arquata** *Say.*

(Plate XXXII, Fig. 16.)

Size 4½ mm. of a more or less lighter or darker brown color. I found the nymphs of this species on July 31 at Newark on *Robinia pseudacacia,* on the lower branches of which they occurred in great abundance, when male adults had been only sparsely represented. On August 14, nymphs in all stages were taken together with adult insects males still predomin

On August 27 another extensive series of nymphs of different stages were collected, and from these adults of both sexes were obtained. As already known this species of Membracidæ is one of the greatest favorites of ants; I uniformly found them to be herded by the latter.

Campylenchia *Stål* curvata *Fabr.*

Plate XXXII, Fig. 17.

Size 6 mm., of a green and brown color. This I found in 1910, only here and there an adult insect, on *Solidago*. I received two from Mr. H. Mueller, taken in the Bronx, New York City, which after several days developed into female adults on July 1.

Enchenopa binotata *Say.*

I found this species near Newark on *Quercus* and *Juglans* as reported in the 'Journal' of the New York Entomological Society, Vol. XX, pp. 58–67. Not having time to color the drawing of nymphs from life, I had to use the shed skins for the many features and to put in the colors from memory. Like the green examples, so the darker nymphs for the ventral part of abdomen are more or less dull green, as a rule. The insects with more than one color usually have the abdomen green; the prothorax wing pads and abdominal prominences and the anal region exhibit darker colors. After shedding its nymphal skin the adult insect seems at first to display a light yellow, green or whitish coloration, but after a short time it assumes its characteristic darker colors.

In the season of 1910 I obtained altogether specimens of some twenty-eight species at Newark, Montclair, and Elizabeth, N. J., and at Woods Hole, Mass.; through the kindness of Prof. W. M. Wheeler, I also received specimens of *Entylia sinuata* Fabr. in different variations. One *Telamona ampelopsidis* Harr., a female, was collected by Mr. C. Buchholz in August. Mr. R. Dow favored me with Membracidæ collected by him in New Mexico. Among these I found a variation of *Glossonotus univittatus* (Harr.) including four examples equally divided as to sex; a very interesting species of a small *Telamona* represented by five examples of which one was a male; two different species of *Stictocephala* (Stål) both represented by a single male, and three other exceedingly small insects, two males and one female, which I could not determine. From Mr. C. L. Pollard I also received several interesting insects collected in the Ramapo Mountains, and at Lakehurst, N. J.

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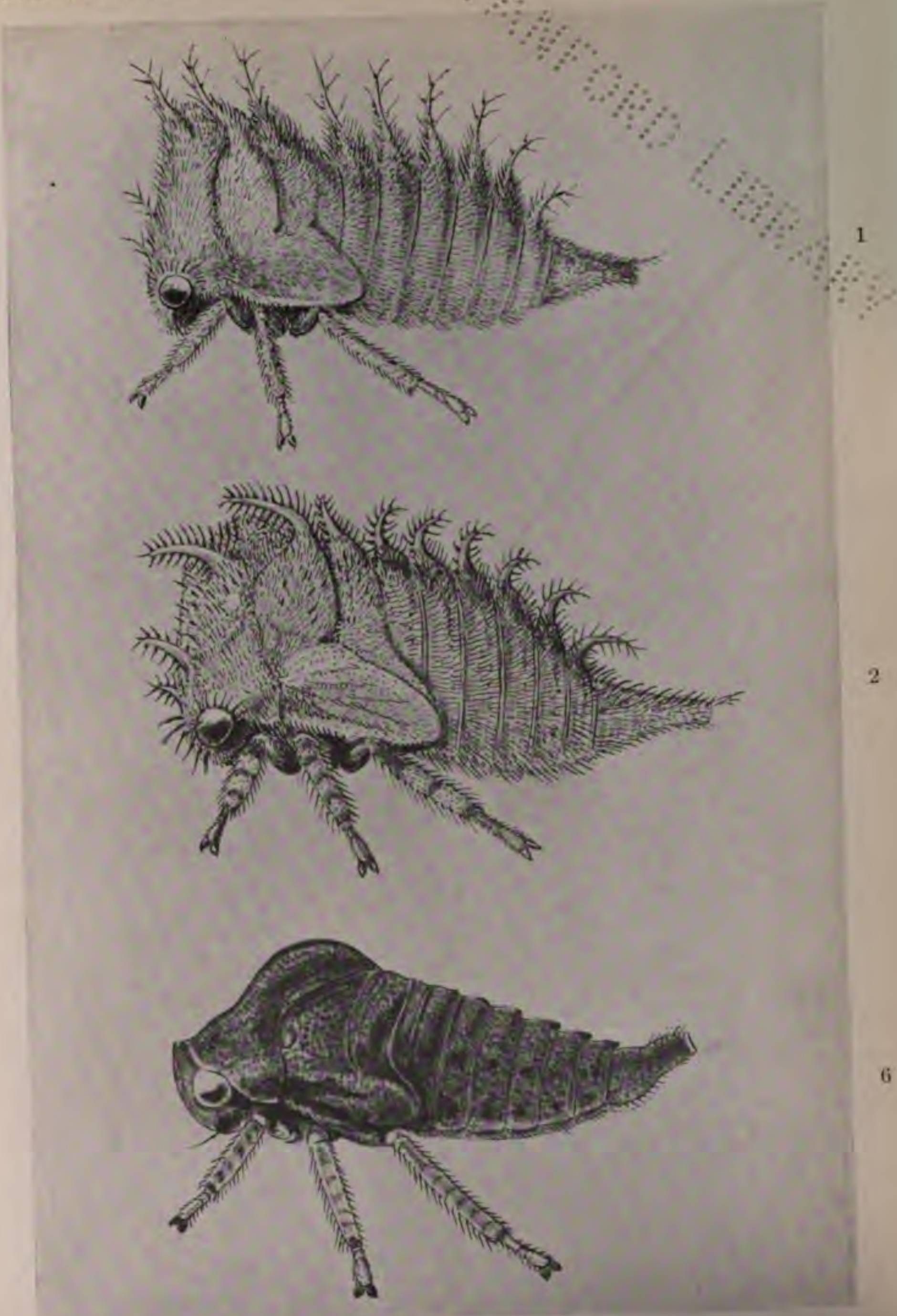
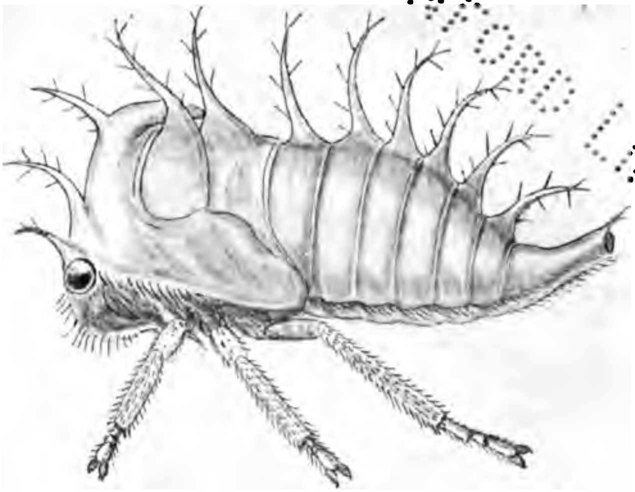


NYMPHAL STAGES OF NORTH AMERICAN MEMBRACIDÆ.

1. *Cereza albescens* Van D. Size 7 mm. 2. *Ceresa bubalus* Fabr. Size 8 mm.
6. *Carynota mera* Say. Size $7\frac{1}{2}$ mm.



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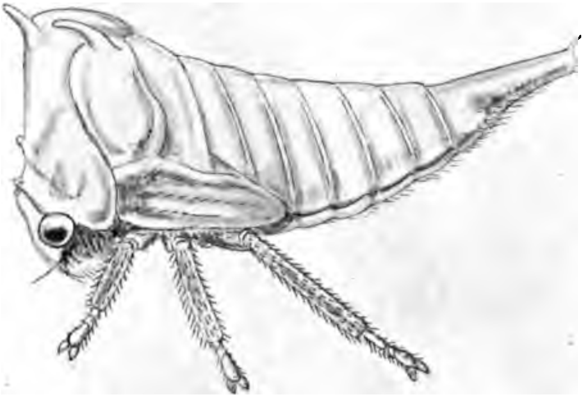

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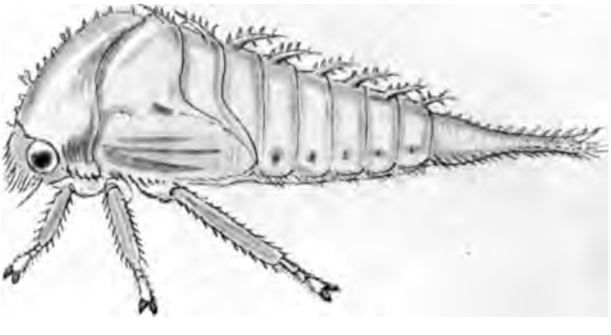

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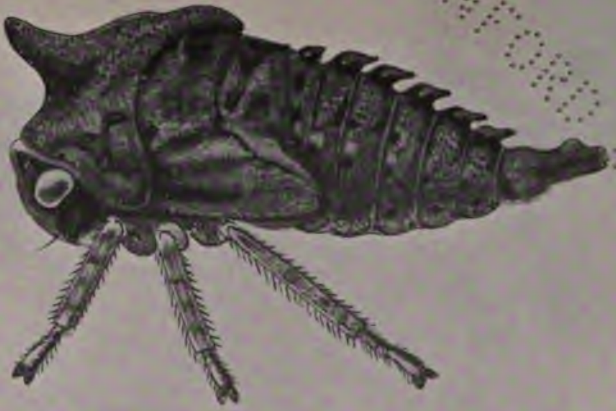
NYMPHAL STAGES OF NORTH AMERICAN MEMBRACIDÆ.

3. *Ceresa taurina* Fitch. Size 7½ mm. 4. *Ceresa palmeri* Van D. **Size 6½ mm**
5. *Acutalis semicrema* Say. Size 5½ mm.



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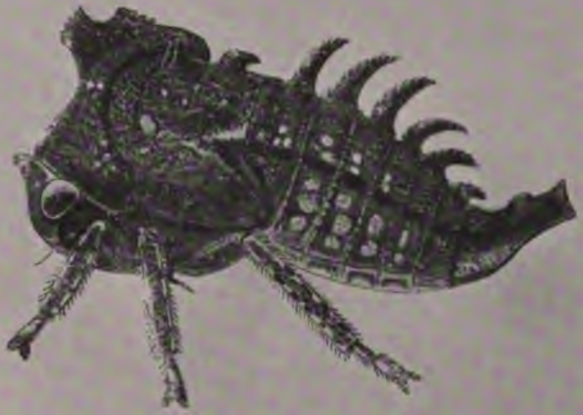

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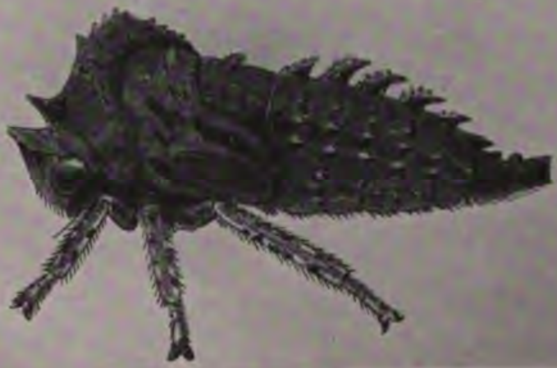

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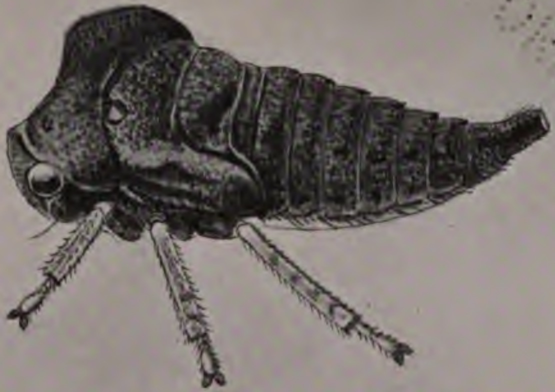
NYMPHAL STAGES OF NORTH AMERICAN MEMBRACIDÆ.

7. *Thelia bimaculata* Fabr. Size 8½ mm. 8. *Telamona* sp. Size, 8¼ mm.
9. *Telamona barbata* Van D. Size 7 mm.



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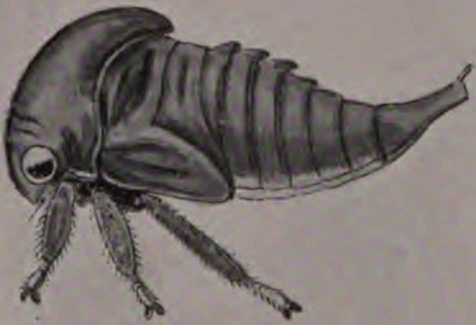

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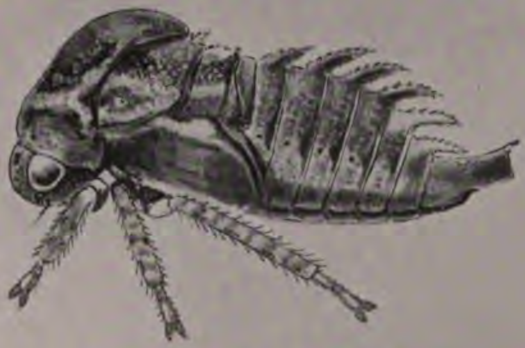

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NYMPHAL STAGES OF NORTH AMERICAN MEMBRACIDÆ.

10. *Telamona unicolor* Fitch. Size 7½ mm. 11. *Cyrtolobus* sp. Size 4½ mm. 12. *Cyrtolobus* sp. Size 5½ mm.

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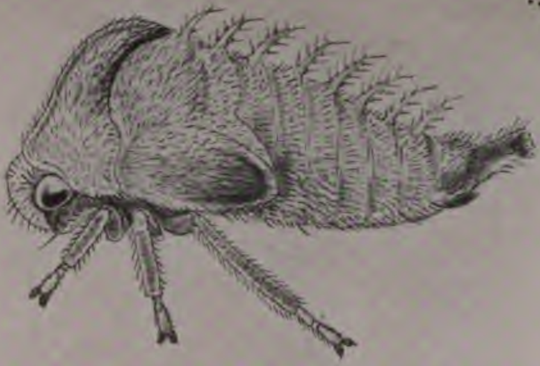

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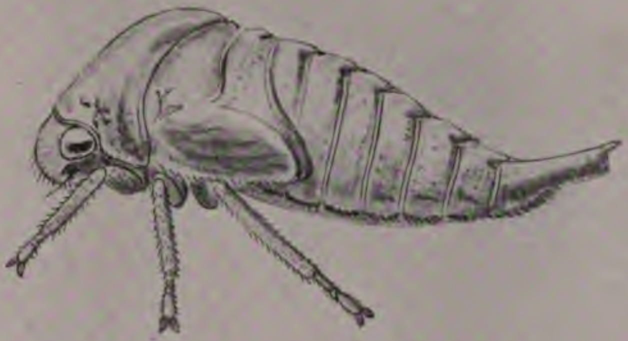

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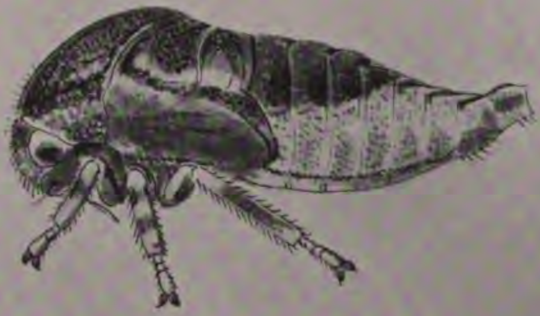

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NYMPHAL STAGES OF NORTH AMERICAN MEMBRACIDÆ.

13. *Cyrtolobus* sp. Size 6 mm. 14. *Cyrtolobus querci* Fitch. Size 6 mm.
15. *Ophiderma* sp. Size $5\frac{1}{2}$ mm.

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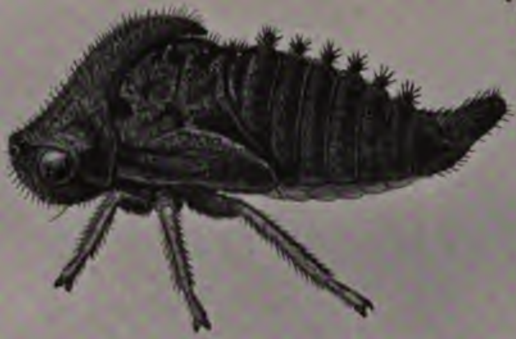

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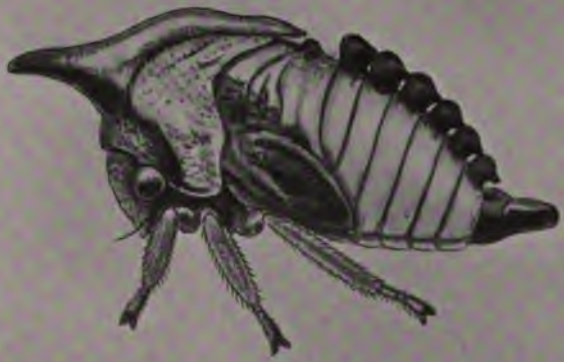

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Figuren gezeichnet nach meinen von der
Natur gemalten Wasserfarbenbildern

Ignaz Matausch

NYMPHAL STAGES OF NORTH AMERICAN MEMBRACIDÆ.

16. *Vanduzea arquata* Say. Size 4½ mm. 17. *Campylenchia curvata* Fabr. Size 6 mm.

59.57,71B

Article XXVII.— THE DIPTEROUS GENUS *BIBIODES*.[1]

By A. L. Melander, Pullman, Washington.

In the 'Proceedings' of the Entomological Society of Washington, D. C., volume VI, number 3 (July 30, 1904) Mr. D. W. Coquillett erected the genus *Bibiodes*, describing one species, *B. halteralis*, from California specimens. No other species of the genus has since been described, and the genus seems not to have been again recognized. Even Williston's 'Manual' includes it with a query.

Recently on reviewing the Bibionidæ in my collection I noticed two other species of *Bibiodes*. As some of the specimens belong to the American Museum, and it is desirable to return them at this time, I will present their description herewith.

Bibiodes resembles a small *Bibio*, but it can be at once recognised by its peculiar venation. The third vein bends down meeting the fourth where the anterior cross vein is usually located, and then both continue coalesced for some distance before separating. Thus the small cross vein is absent. The costa, first and third veins are distinct, blackish, the base of the auxiliary and of the fourth vein brownish, the other veins faint. Discal cell emitting three posterior veins, of which the anterior two sometimes are joined forming a short petiole to the second posterior cell. The anal cell open. Eyes of the male contiguous between the ocelligerous tubercle and the antennæ, the upper facets moderately coarse, the facets of the lowermost sixth, below the level of the antennæ, fine. Antennæ short, 9-jointed. Palpi 4-jointed, moderately long: proboscis rudimentary. Front tibiæ with a sharp exterior edge and ending in a strong spur, within with a minute spur, also. Empodium broad; pulvilli absent.

The three species at present known are western. Evidently like other members of the family, they are locally common. The following summary of characters will help to identify them.

Costa extending half way from the stigma to the apex of the wing; front femora robust; hind metatarsi short; halteres and legs black; pubescence conspicuous; hypopygium large; second posterior cell petiolate..........**femorata** sp. n.

Costa extending more than half way from stigma to apex of wing; legs less robust; hind metatarsi much longer than the following joint; legs of ♀ reddish; pubescence more sparse; second posterior cell sessile or short petiolate..........2.

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[1] Contribution from the Zoölogical Laboratory of the State College of Washington.

2. Legs ♂ black; halteres yellow; eyes hairy; hind tarsal joints rounded; ple strigose; hypopygium moderate; stigma oval.....**halteralis** Coquill
   Legs ♂ variegated; halteres black; eyes bare; hind tarsal joints cylindri pleuræ smooth; hypopygium closed; stigma excised above...**æstiva** sp

Professor J. M. Aldrich has called my attention to a genus *Synneu* described by Carl Lundström from Finnland.[1] A reference to this ge occurs in the 'Wiener entomologische Zeitung' for January, 1911, page but the paper is not listed in the 'Zoological Record' for 1910. I h been unable to secure a copy of Lundström's article and cannot theref state what relationship the Finnland genus bears to our forms. The na *Synneuron* is suggestive of the essential characteristic of ***Bibiodes***, fusion of the third and fourth veins, but may, of course, not refer to peculiarity.

Bibiodes æstiva sp. nov.

Male. Length 2.5 mm. Jet black, shining, sparsely covered with comp tively short, golden hairs, the hairs of the abdomen whitish. Antennæ comp tively long, measuring about equal to the front metatarsus, the individual jo but little wider than their length. Eyes bare. Pleuræ and front femora pla strigose. The thoracic hairs are arranged in two single rows dividing the mesono into thirds, and in loose bunches above the root of the wings and on the scutell pleuræ bare. Hypopygium with a pair of laterally moving forcipate valves, lower inner edge of which is provided with a fuscous thumb-like process, the interlocking. Knob of halteres black, the pedestal fuscous. Legs shining bl except that the spur of the front tibiæ, the basal half of the posterior tibiæ, and base of the individual tarsal joints, rufous. All the femora moderately incrass the front ones but little more thickened than the others: front legs comparati longer than in *femorata:* outer edge of the hind tibiæ a little sinuate so that the est part of the tibia is before the tip: hind tarsi nearly as long as the hind tibiæ. metatarsus nearly as long as the following two joints together, the outline of individual joints rounded: pubescence of the legs short, in length less than one- the diameter of the tibia. Stigma oval saturate fuscous, costa extending th fourths the distance beyond the stigma to the wing-tip, second posterior cell of broadly sessile with the discal cell, the faint veins broad and brownish.

Sixteen males. Almota, Washington, June 24, 1911. Craig's Mo tain and Lewiston (June 11, 1904), Idaho, from Professor Aldrich. Carl County, Wyoming, received from Mr. William Beutenmüller from the c lection of the American Museum of Natural History. Copperopolis, M tana, July 23, 1902, elevation 5400 feet; and Gallatin Valley, Monta July 6, 1903. The last two were received from Professor R. A. Cool

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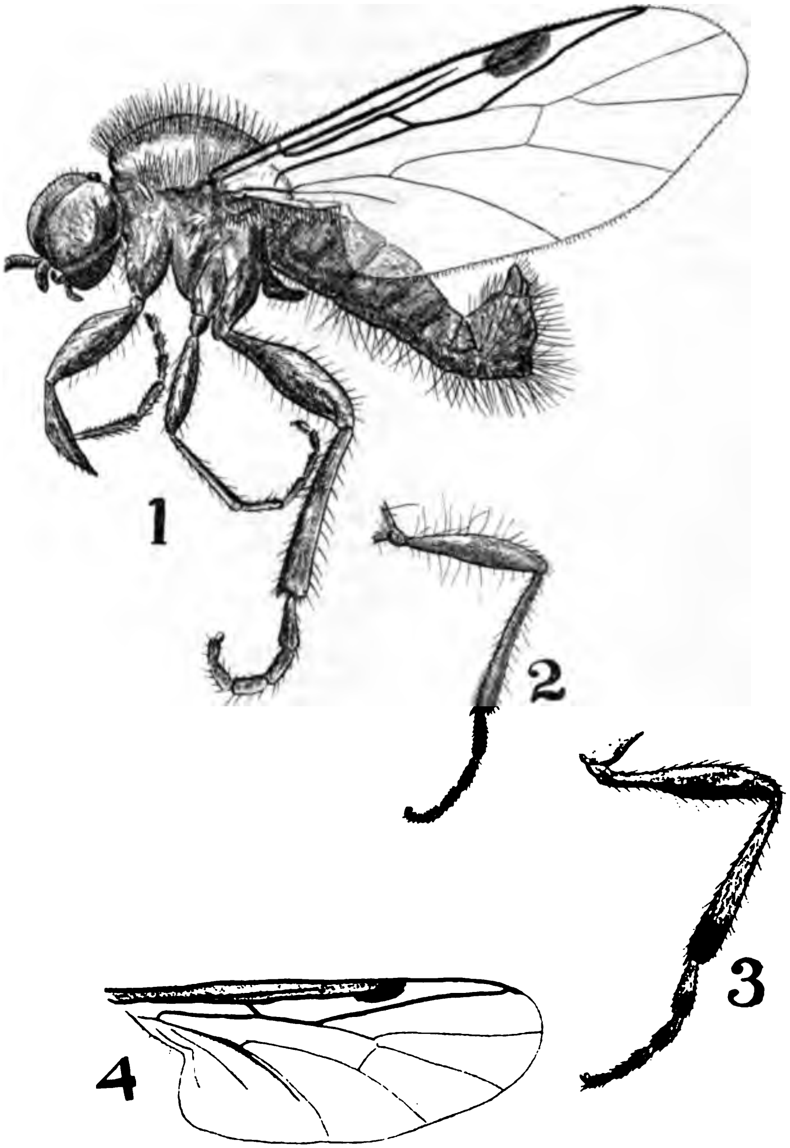
[1] Beitraege zur Kenntniss der Dipteren Finnlands. V. Bibionidæ. Acta societ pro Fauna et Flora Fennica, vol. 33, nr. 1, 15 pag., 1 pl. Helsingfors, 1910.



Explanation of Plate.

Fig. 1. *Bibiodes femorata* ♂.

Fig. 2. *Bibiodes halteralis* hind leg.

Fig. 3. *Bibiodes æstiva*, hind leg.

Fig. 4. *Bibiodes halteralis*, wing.

of the Montana Agricultural College. These types have been distributed among the collections of the American Museum, New York City, the Montana Agricultural College, Professor J. M. Aldrich, and myself.

A female from Craig's Mountain, Idaho, presents the following peculiarities: Hairs shorter, coarser and deeper golden-yellow. Legs including coxæ reddish, darker at tips of the femora, posterior tibiæ and tarsal joints (except immediate base of individual joints of posterior tarsi), and front tarsi almost black; front coxæ and femora greatly thickened. Abdomen plump, broad, nearly bare, possessing eight tergites, and with a pair of oval brown terminal flaps.

Bibiodes femorata sp. nov.

Male. Length 2.5 mm. Jet black, shining, provided with conspicuous pale golden hairs, the hairs of the abdomen almost white. Antennæ short and thick, measuring about two-thirds the length of the front metatarsi, the individual joints much wider than long. Eyes pubescent. Pleuræ very faintly strigose, almost smooth. The thoracic hairs long and golden, arranged as in *æstiva* in two longitudinal rows and bunches along the sides, front and back of the notum, but the hairs much more numerous and also longer: pleuræ also provided with hairs. The thumb-like process of the hypopygial valves not pale in color. Halteres entirely black. Legs very robust, shining black, the spur of the front tibiæ fuscous: the front femora greatly thickened, the front tibiæ shorter and stouter than in *æstiva:* hind tibiæ gradually enlarged to the end: hind tarsi plainly shorter than the tibiæ, the metatarsus much shorter than the two following joints together, the profile of the individual joints quadrate; pubescence of the legs evident, nearly as long as the diameter of the tibiæ. Wings lightly infumated, stigma brownish, oval; costa extends half way from the stigma to the tip of the wing; veins faint, inconspicuous, brownish.

Female. Like the male except for the differences of sex in the eyes and abdomen. the legs are less purely black.

Described from nine males and two females, collected by myself at Austin, Texas, December 13, 1899. The types have been placed in the collections of the American Museum of Natural History, of Professor J. M. Aldrich, and of myself.

Bibiodes halteralis *Coquillett.*

The type species of the genus differs from the two here described in having yellow halteres. The legs of the male are entirely black. In the female the front coxæ, all the femora, and the front and hind tibiæ are reddish.

This, like *femorata*, is a winter species. Mr. Coquillett's specimens came from California, and were taken December 19 to March 18. I have two males before me from Professor Aldrich's collection, caught by Professor

C. F. Baker at Claremont, California. These specimens permit the following additions to Mr. Coquillett's characterizations.

Mesonotum provided with rather long hairs, becoming sparse on the abdomen Eyes conspicuously hairy. Antennæ comparatively slender, as in *æstiva*. Pleuræ smooth, polished, and hairy. Hypopygium small, not open, nor enlarging the end of the abdomen. Hairs of femora very fine, some of them longer than the femoral diameter; the hind tibiæ gradually enlarged to the end; the hind tarsi comparatively slender, their joints cylindrical, and with the upper side less rounded in outline, the hind metatarsus but little longer than the following joint. Wings not at all infumated, the faint veins milky white, inconspicuous; the strong veins blacker than in the other species, the costa curves around the tip of the wing ending four-fifths the distance beyond the stigma to the tip; the blackish stigma does not include the end of the marginal cell: the second posterior cell touches the discal cell or else is very short petiolate.

59.57,5(94)

Article XXVIII.— NEW OR LITTLE KNOWN HEMIPTERA, CHIEFLY FROM AUSTRALIA, IN THE AMERICAN MUSEUM OF NATURAL HISTORY.

BY E. BERGROTH.

THYREOCORIDÆ.

Blæna setosa *Walk.*

Distant has placed *Macrymenus membranaceus* Sign. as a synonym of *Blæna setosa*, but if I have interpreted Walker's species correctly, as I think I have, they are specifically distinct. In *membranacea* the hind tibiæ of the male are curved basally and apically, the basal curvature turning its concavity inward, the apical curvature outward; in *setosa* the hind tibiæ are perfectly straight in both sexes. The head and pronotum are also more longly setose in *setosa*. Walker says in his description: "corium bilobed on the exterior border," meaning the apical margin with the expression "exterior border." New South Wales.

COREIDÆ.

HYOCEPHALARIA,

Hyocephalus aprugnus *Bergr.*

Brachypterous form: Pronotum slightly narrowing from the base to the apex, much narrower than the width across the hemelytra, slightly broader than its median length, at the apex as broad as the head, lateral margins a little rounded, slightly reflected from the apex to beyond the middle, then scarcely reflected at all, basal margin moderately sinuate, posterior part of propleuræ not visible from above outside the pronotal lateral margins. Hemelytra about twice the length of the scutellum, with no membrane, lateral margin of corium rounded, more strongly so behind the middle, apical angle rounded, apical margin somewhat sinuately oblique, forming jointly with the apical margin of the other corium a continuous arched sinuosity. Length ♀ 12 mm. The third antennal joint, which was lacking in the type, is about half the length of the second joint. New South Wales.

After a renewed study of this extraordinary genus, for which even a separate family has been proposed, I find that, the very aberrant venation and the position of the antennæ notwithstanding, it can be included as a division in the family Coreidæ, to be placed near Stål's Division Cyllararia, founded on the single genus *Cyllarus* Stål, with which *Hyocephalus* has the *facies* and several characters in common. The male sex of *Hyocephalus* is still unknown.

MYODOCHIDÆ.

Cænocoris augur *Stål.*

In fresh specimens the ground-color of the membrane is blue and the sterna are covered with a bluish bloom except the hind borders of the propleura and mesopleura which are velvety black. Queensland (Brisbane, *H. Edwards*).

HENICOCEPHALIDÆ.

Henicocephalus aërius n. sp.

Fuscous, the knees broadly pale testaceous, the head, pronotum, and scutellum thickly pilose. The postocular lobe of the head narrower than the breadth across the eyes, about as long as broad, seen in profile more elevated than the anteocular part, antennæ shortly and rather densely pilose with scattered exserted long hairs intermixed especially on the fourth joint, first joint passing the apex of head, third joint shorter than second and fourth which are of equal length. Pronotum with the fore lobe half as broad as the median lobe, which has a ⊥-shaped impression in the middle and on either side an oblique impression emitting a short branch outward and forward, hind lobe three-fourths broader than the median lobe, longitudinally feebly carinated in the middle, its basal margin very slightly obtusangularly sinuate. Scutellum moderately convex. Hemelytra rather longly passing apex of abdomen, discal cell closed. Wings longer than abdomen. Abdomen on the sides fringed with hairs. Legs pilose, fore femora moderately incrassated, fore tibia at apex almost as broad as the femora in the middle. Length with hemelytra 7 mm. New South Wales.

Allied to *H. tasmanicus* Westw., but with the pronotal base less sinuate and unicolorous hemelytra.

REDUVIIDÆ.

Piestolestes nov. gen.

Body strongly depressed. Head horizontal, longer than pronotum, postocular part shorter than anteocular part, transverse impression between the eyes curved, antennæ a little farther distant from the apex of the head than from the eyes, first joint shorter than the head, second joint much shorter than first, third a little longer than second, rostrum reaching base of head, first joint much shorter than anteocular part of head, reaching base of antennæ or even shorter, second joint two times longer than first. Pronotum constricted and transversely impressed near the middle, anterior lobe at the base foveately longitudinally impressed with the apical angles acutely prominent, basal margin of posterior lobe confluent with the posterior lateral margins without forming an angle, narrowly reflected, lateral angles rounded, not prominent. Fore femora with a double series of spines beneath, much longer than the tibiæ. Middle and hind femora and tibiæ subequal in length.

Type: *P. lineatus.*

To this genus also belong *Havinthus obscurus* Bergr. and, in all probability, *H. trochanteratus* Dist., in the description of which the shape of the pronotal apical angles and the length of the rostral joints and of the tibiæ are not mentioned.

The genus is allied to *Havinthus* Stål, from which it differs by the much shorter basal joint of the rostrum, the acutely prominent pronotal apical angles, the spined fore femora, and by the tibiæ, especially the first pair, being much shorter.

Piestolestes lineatus n. sp.

Piceous black, corium a little paler, connexivum through its whole length traversed by a longitudinal very densely and shortly tomentose whitish ochraceous line, trochanters red. Head with a short but rather deep impressed longitudinal line between the eyes in front of the transverse impression, distance between eyes and base of antennæ as long as the longitudinal diameter of the eyes, the whole underside and the sides and upper surface of the postocular part granulated, second antennal joint about as long as the distance between the inner margins of the eyes, last two joints tawny, first rostral joint reaching base of antennæ. Pronotum as long as broad, anterior lobe smooth, its apical border slightly wrinkled and granulate, posterior lobe finely but not densely transversely rugulose. Scutellum with a median triangular impression which is covered with a thick but short grayish tomentosity. Hemelytra (♀) reaching base of dorsal genital segment. Connexivum longitudinally strigose, entirely exposed but not broad. Venter very finely transversely strigulose. Fore femora granulated, middle and hind femora more sparingly so. Length ♀ 13 mm. Queensland (*H. Edwards*).

Allied to *P. obscurus* Bergr., but differently colored with basal joint of rostrum distinctly longer and the pronotal apical angles a little less acutely prominent.

N. B. In the genus *Havinthus* the rostrum reaches the fore coxæ, its basal joint is but slightly shorter than the anteocular part of the head, the second joint much less than two times longer than the first, the apical angles of the pronotum are rounded, the fore femora are not spined, the fore tibiæ reach the trochanters, and the middle and hind tibiæ are longer than femora. As type of this genus I herewith fix *H. longiceps* Stål, with *H. pentatomus* H. Sch. is apparently congeneric.

Ectomocoris ornatus *Stål.*

Apterous form: Lobes of pronotum of equal breadth, anterior lobe almost four times longer than posterior lobe. Scutellum much broader than long, reaching the middle of metanotum, its sides rounded, the apex prolonged in a short robust upturned spine. Mesonotum with a lateral tubercle on each side. Hemelytra rudimentary, forming two blue scales which are exteriorly rounded and transversely wrinkled behind the middle and do not reach posterior margin of pronotum, with the surface of which they are fused. ♀. New South Wales (*H. Edwards*).

Hermillus edo n. sp.

Piceous, a spot on each side behind the upper part of the eyes, a narrow apical ring to the first antennal joint and the second joint beneath testaceous, corium with an oval orange-yellow spot touching the middle of the apical margin, veins of membrane obscurely testaceous, abdomen brownish testaceous, apical half of fore and middle femora and apical third of hind femora cinnabar red, base and apex of tibiæ and the tarsi testaceous; slightly shining, hemelytra, except basal part of costal margin, opaque. Head as long as posterior pronotal lobe, beneath with a dense but very short pilosity intermixed with scattered long hairs, above remotely and shortly pilose, posterior margin of eyes viewed from the side rather deeply sinuate below the middle, antennæ pilose, first joint subglabrous, as long as the anteocular part of the head, second joint as long as the pronotum, linear from the apex to the middle, then somewhat incrassated toward the base, rostrum above with a few long erect hairs, beneath more densely but rather shortly pilose, basal joint reaching base of antennæ, second joint a little longer than first. Pronotum one-fifth broader than long, anterior lobe bluntly remotely sculptured, apical angles obtusely tuberculate, posterior lobe smooth, median longitudinal impression not reaching base with a series of large impressed points, intrahumeral longitudinal impressions transversely rugose, lateral angles rounded, a little prominent. Scutellum at apex produced in a rather robust, compressed, slightly upturned spine. Hemelytra reaching apex of abdomen. Wings somewhat infuscated. Venter transversely rugulose, the last three segments moreover very finely punctured in places, male genital segment transversely impressed before apex, genital styles incrassated toward apex. The spongy pit of the fore tibiæ occupying their apical fourth. Length ♂ 19.5 mm. West Africa (Liberia, *Miss Mahoney*).

Broader than *H. geniculatus* Sign., differently colored and with the basal joint of the antennæ shorter.

N. B. *Hermillus rufipes* Schout. (December, 1902) is identical with *Cerilocus histrio* Dist. (September, 1902). It was correctly placed in *Cerilocus* by Distant. Dr. Schouteden is not to blame for having placed it in *Hermillus*, for I had seen his species before it was described and had by an oversight marked it as "*Hermillus* n. sp." Schouteden described the species from Cameroon, but he has informed me that the label was probably wrong; it is an East African species.

Stenotæmus edwardsii n. sp.

Longly pilose, ground-color of body, including hemelytra antennæ and legs, whitish. Head with two pale fuscous vittæ on the upper side of the postocular part, sometimes entirely palely infuscated, postocular part with two conical tubercles, rostrum more or less infuscated or blackened, especially the shining second joint, first antennal joint a little longer than prothorax, with four brownish annuli, second joint slightly shorter than first, its apical half and the two last joints infuscated, third joint a little longer than the fore tarsi, fourth joint somewhat longer than third, acuminate at apex; pilosity of first antennal joint and of the basal half of the second joint moderately long and thick with very long apically curved hairs mixed in with it, apical half of second joint and the two last joints shortly pilose. Pronotum with four pale brownish vittæ on the anterior tumid part of the fore lobe, interior vittæ broad, exterior vittæ narrow, posterior petiolated part of this lobe a little shorter than the apical part, posterior lobe, except the blunt median ridge and the basal margin, suffused with pale brown, its disk armed with two strong slightly divergent conical tubercles. Scutellar and postocutellar spine obliquely ascending. Hemelytra glabrous except costal margin which is fringed with rather short curved hairs, mesocorium margined with fuscous along the veins bordering it interiorly and apically, anterior cell of membrane more or less palely infuscated in the middle without transverse veins, posterior membranal cell with a large oblique subtriangular fuscous blotch enclosing an irregular ramose whitish vein, interior apical cell broadly infuscated at the interior border with two or three cretaceous white transverse veins, exterior apical cell infuscated except at the interior border and sometimes in the middle, and with an irregular median ramose whitish vein, terminal cell fuscous, the veins separating the apical cells from the posterior cell and from each other cretaceous white. Abdomen beneath more or less infuscated at the sides and toward the apex. Legs with very long whitish pilosity, the hairs of the middle and hind tibiæ becoming gradually shorter toward the apex, femora with four brown annuli, fore tibiæ with three and the other tibiæ with two brown annuli in their basal half, base of middle and hind femora and extreme apex of middle and hind tibiæ also brownish, apex of fore tarsi and the whole middle and hind tarsi fuscous, the brown annuli of the four posterior legs bearing, besides the ordinary long pilosity, a shorter and thicker brown tomentosity; fore coxæ as long as the apical tumid part of the prothorax, fore femora a little shorter than the pronotum, their spinelets and those of the tibæ or at least their tips black, basal spine of femora rather strong, slightly curved. Length without membrane ♂ 8.5–9, ♀ 10 mm., with membrane ♂ 10.5–11, ♀ 12 mm.

Male: distance between inner margins of eyes as broad as an eye; abdomen narrow, linear, the angles of its segments not prominent, genital segment at apex with two straight slender parallel processes, claspers slender, curved at apex, passing apex of the processes.

Female: distance between inner margins of eyes almost twice broader than an eye; abdomen dilated, elongately suboval, with the margin triangularly lobed at the junction of the segments (except the junction of segments 1 and 2), the two median lobes on each side being larger and more prominent and each lobe consisting of an outer and an inner portion belonging respectively to the outer and inner margin of the connexivum. Victoria (*H. Edwards*).

Seems to be allied to the insufficiently described *S. bispinosus* Westw., but as the markings of the hemelytra in that species are apparently quite different, there can be little doubt that it is distinct.

N. B. In this genus the posterior part of the outer apical cell is separated from the remainder of the cell by an oblique vein running from near the end of the narrowly prolonged outer apical part of the corium to the apex of the membrane; this cell I call the terminal cell.— Signoret, Stål and Horváth in their descriptions of species of this genus have misinterpreted the females as males. The male sex was obviously unknown to these authors.

MIRIDÆ.

Lygus neovalesicus n. sp.

Pale greenish testaceous, sometimes slightly rufescent beneath, extreme apex of cuneus and apical half of last tarsal joints fuscous, membrane subhyaline with pale greenish or testaceous veins, a spot at the outer apical angle of the inner cell and at the apex of the outer cell, and a short oblique fascia behind the apex of the cuneus pale fuscous gray. Head transverse, more so in the male, vertex margined, slightly narrower (♂) or a little broader (♀) than an eye, clypeus separated from forehead by a distinct impression, its base opposite base of antennæ, eyes viewed from the side almost perpendicular, occupying the whole (♂) or three-fourths (♀) of the head's height, rostrum slightly passing base of abdomen, antennæ longer than the body (without membrane), first joint as long as the distance between the scrobes, second joint more than three times longer than first and one-third longer than breadth of pronotum, sublinear, last two joints together a little shorter than second, fourth a little longer than half the length of third. Pronotum finely transversely striolate, scarcely punctured, with very short pale pubescence, more than one-half broader than its median length and three times broader posteriorly than at apex, lateral margins scarcely rounded, collar very narrow. Scutellum very finely transversely wrinkled. Hemelytra passing apex of abdomen by half (♀) or three-fourths (♂) the length of the membrane, finely punctured, clothed with decumbent pallid hairs, cuneus somewhat (♀) or considerably (♂) passing apex of abdomen, inner cell of membrane a little longer than cuneus, its inner apical angle rounded. Abdomen beneath with whitish decumbent hairs. Femora with two short divergent bristles at apex, spinelets of tibiæ brownish testaceous without darker points at their base, hind tibiæ four times longer than the tarsi. Length ♂ 3.9, ♀ 4.3 mm., with membrane ♂ ♀ 5.2 mm. New South Wales.

Closely allied to the cosmopolitan *L. apicalis* Fieb. and very similar to its variety *prasina* Reut., but readily distinguished by the considerably longer second antennal joint and some other details of structure.

59.78A:14.78,1

Article XXIX.— ON THE HAIR-LIKE APPENDAGES IN THE FROG, *ASTYLOSTERNUS ROBUSTUS* (BLGR.).

By Bashford Dean.

The presence of hair-like appendages in a batrachian, first noted by Boulenger in 1900, is in itself so extraordinary a morphological fact, that we cannot wonder that it has already been commented upon by several observers,— especially as to the probable function of these organs. Thus Doctor Hans Gadow ('00) points out that the appendages could hardly have been sensory in function, for he found no nerve terminals in them: he noted, however, that they contain lymph spaces and insignificant blood vessels. He later states (1901) that they were studied by Mr. F. F. Laidlow, tells us that "their most remarkable feature is the presence in them of a great number of ordinary flask-shaped cutaneous glands, while such glands are scarce on the surrounding skin," and he repeats his statement that the hairs are lacking in sensory structures. Mr. Boulenger in a second paper ('02) makes it clear that the "hairs" occur only in the male, but he gives us no clue as to their significance. And very recently (Feb. 1912) Dr. Kükenthal, examining the specimens in the Museum of Comparative Zoölogy of Cambridge, Mass., states that the hairs are to be regarded as highly developed tubercles of the skin and he interpreted them "as secondary sexual organs, charged with sensory functions." He comments upon their appearance "only on those areas of the surface where, according to Merkel, in other frogs these tactile cells ('Tastflecken') form aggregations." Kükenthal gives in his paper a transverse section of one of the "hairs" in which appear blood-vessel, cutis and epidermis, and he figures also a portion of a longitudinal (radial) section in one of the cutis ridges: in this are seen chromatophore, nerve fiber, and "tactile cells." The last, we infer from his text, were noted only after impregnation of the tissue by Bielschowsky's method.

The American Museum has recently received from Doctor Thomas Barbour, in an exchange with the Museum of Comparative Zoölogy of Cambridge, one of the specimens of *Astylosternus*, which Kükenthal examined; and the study of the disposition of the "hairs" and of their structure has led to recording the present notes:

First of all, assuming that these "hairs" are developed by the male and only at spawning time, and that they attain, as Kükenthal's figure shows, great length in certain specimens, one is led to correlate this with a habit of brooding not uncommon among amphibians generally. It is known, for example, that in various salamanders,— *Cryptobranchus*, *Amphiuma*,— in *Ichthyophis*, *Alytes*, in various Hylids and in *Rhacophorus reticulatus*, the eggs when extruded are wrapped about or attached to the body, in each species in one sex only, usually the male. In the case of the present frog, therefore, it is but necessary to compare the condition with that of such a form as *Alytes* (*cf.* Figs. 1 and 2) in which it is known that egg-strings are attached to the sides of the body and the thighs, to obtain more than a suggestion as to the function of these hair-like processes, *i. e.*, that they were used for retaining the egg-strings in such position that they could be readily transported, guarded, and probably oxygenation as well. It will be recalled in this connection that the lungfish, *Lepidosiren paradoxa*, which has also the brooding habit, develops on its ventral appendages hair-like processes which are suffused with capillaries, and admirably adapted to bring oxygenated blood in close contact with the mass of eggs. In this instance we can safely conclude that the hair-like processes function as an accessory respiratory organ for the developing young.

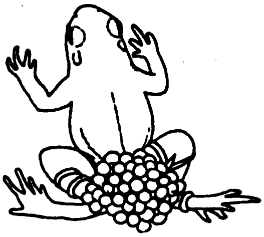


Fig. 1.

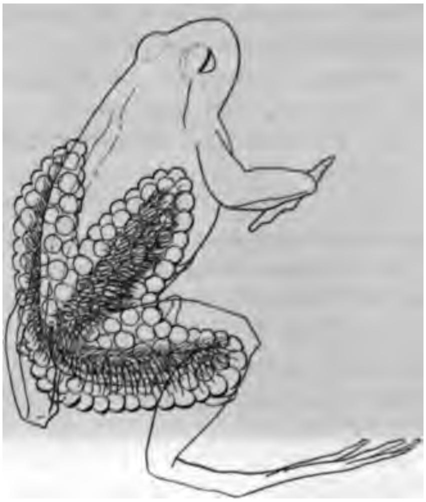


Fig. 2.

In fact the histological notes which Kükenthal has given are not opposed to the present view. Each hair is vascular: its core of cutis is made up of spongy tissue; furthermore, from the arrangement of the surrounding epidermis in curious ridges, we suggest that the circumference of the hair could have been notably dilated; we note also that pigmentation is largely abandoned and that the number of delicate nerves with terminal cells, which

Kükenthal has described, would be no more than one would expect in a specialized structure of this kind,—for after all, the appendages are dermal and secretory and as such would be apt to be provided with nerves and sensory elements.[1] If, however, their function were exclusively or even largely sensory, as Kükenthal maintains, we would reasonably —by numerous analogies in the appendages of amphibia and fishes,— expect that the sensory organs should be far more conspicuous. Then too, if the former view is to be accepted, one would expect to find among amphibia sensory structures developed seasonably. But this is a condition which apparently does not occur.

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[1] My sections show that nerve endings are demonstrated only with difficulty — as one would expect in the case of nerve terminals in cutaneous glands.

59.57:03 (74.7)

Article XXX.— TYPES OF INSECTS, EXCEPT LEPIDOPTERA AND FORMICIDÆ, IN THE AMERICAN MUSEUM OF NATURAL HISTORY ADDITIONAL TO THOSE PREVIOUSLY LISTED.

By John A. Grossbeck.

Five lists of the types of insects in the possession of the Museum have thus far been published, all of them by Mr. Wm. Beutenmüller. The first (1892) was a list of the types of Lepidoptera described by Grote and Robinson, the second (1892) comprised a list of the types of the same order in the Edwards collection, the third (1904) listed the types of Cynipidæ, the fourth (1904) those of the Lepidoptera added to the collection since the publication of the previous two lists, and the fifth (1904) those of the Diptera.

The present paper is an enumeration of the hitherto unlisted types of all orders excepting the Formicidæ, the collection of which is in the hands of the honorary curator of social insects, Dr. Wm. M. Wheeler of Boston, and the additions in the Lepidoptera, a list of which will be prepared at a later date.

A number of types were added in the Diptera by the purchase of the Williston South American collection. The acquisition of the Krausse collection of European *Bombus* and a duplicate collection of Coccidæ from Mr. Geo. B. King also added a number. Others, from time to time, were donated or came through the Museum's policy of loaning materal to monographers and specialists, the types of new species always being returned to the Museum. And finally, the work of Mr. Beutenmüller on the Cecidomyidæ and Cynipidæ increased the total by not a few more.

In the following list the genus in which the species were originally described is first given, and when this has later been referred to another genus the fact is indicated by the new genus being inclosed in parentheses after the older one.

The expressions type, cotype and paratype as here used have not always the same meaning owing to the lack of uniformity among systematists in the use of these terms. Thus the word "type" is here sometimes equivalent to "cotype" and vice versa, and "cotype" to "paratype." No rule is followed in this list and whatever the author called and labelled his specimens, so they have been listed here. In one instance it was for us to label the types ourselves, but this was done according to directions received from the author of the species.

Finally it should be mentioned that there are in the Museum's collections a number of "types" of Cynipidæ and Diptera which are apparently manuscript types and whose descriptions will undoubtedly never be published. These have not been included in the present list. Where, however, manuscript names are to be published in the near future they have been listed.

Order PLECOPTERA.

Family PERLIDÆ.

Perla carolinensis *Banks*, Bull. Am. Mus. Nat. Hist., XXI, 215, 1905. Seven types.

Leuctra grandis *Banks*, Can. Ent., XXXVIII, 338, 1906. Eight types.

Order MECOPTERA.

Family PANORPIDÆ.

Panorpa carolinensis *Banks*, Bull. Am. Mus. Nat. Hist., XXI, 216, 1905. Three types.

Panorpodes carolinensis *Banks*, Bull. Am. Mus. Nat. Hist., XXI, 215, 1905. Three types.

Order TRICHOPTERA.

Family SERICOSTOMATIDÆ.

Atomyia modesta *Banks*, Bull. Am. Mus. Nat. Hist., XXI, 217, 1905. Ten types.

Goera fuscula *Banks*, Bull. Am. Mus. Nat. Hist., XXI, 216, 1905. Two types.

Family HYDROPSYCHIDÆ.

Plectronemia auriceps *Banks*, Bull. Am. Mus. Nat. Hist., XXI, 218, 1905. One type.

Polycentropus carolinensis *Banks*, Bull. Am. Mus. Nat. Hist., XXI, 217, 1905. One type.

Arctopsyche irrorata *Banks*, Bull. Am. Mus. Nat. Hist., XXI, 217, 1905. One type.

Order ODONATA.

Family AGRIONIDÆ.

Hetærina infecta *Calvert*, Biol. Centr.-Am., Neurop., 38, 1901. Two cotypes.

Hetærina rudis *Calvert*, Biol. Centr.-Am., Neurop., 40, 1901. One cotype.

Argia ulmeca *Calvert*, Biol. Cent.-Am., Neurop., 80, 1901. One cotype.

Order ORTHOPTERA.

Family BLATTIDÆ.

Aphlebia (Hololampra) inusitata *Rehn*, Bull. Am. Mus. Nat. Hist., XXII, 113, 1906. One type.

Epilampra (Heterolampra) structilis *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 178, 1909. Two types.

Epilampra (Heterolampra) wheeleri *Rehn*, Bull. Am. Mus. Nat. Hist., XXVIII, 73, 1910. One type.

Eurycotis bahamensis *Rehn*, Bull. Am. Mus. Nat. Hist., XXII, 110, 1906. Two types.

Attaphila fungicola *Wheeler*. Am. Nat., XXXIV, 860, 1900. Eight types.

Family MANTIDÆ.

Hierodula athene *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 180, 1909. One type.

Toxodera pluto *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 182, 1909. One type.

Citharomantis falcata *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 185, 1909. One type.

Family PHASMIDÆ.

Malacomorpha androsensis *Rehn*, Bull. Am. Mus. Nat. Hist., XXII, 114, 1906. One type.

Family ACHETIDÆ.

Nemobius affinis *Beut.*, Bull. Am. Mus. Nat. Hist., VI, 249, 1894. Two types.

Œcanthus quadripunctatus *Beut.*, Bull. Am. Mus. Nat. Hist., VI, 250, 1894. Two types.

Œcanthus pini *Beut.*, Jour. N. Y. Ent. Soc., II, 56, 1894. Two types.

Crystallomorpha sumatrensis *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 209, 1909. Two types.

Family PHASGONURIDÆ.

Pseudorhynchus calamus *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 203, 1909. One type.

Agrœcia aberrans *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 204, 1909. One type.

Cyrtophyllus (Lea) floridensis *Beut.*, Bull. Am. Mus. Nat. Hist., XIX, 637, 1903. One type.

Gryllacris larvata *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 207, 1909. Three types.

Belocephalus sabalis *Davis*, Jour. N. Y. Ent. Soc., XX, 123, 1912. Three paratypes.

Belocephalus hebardi *Davis*, Jour. N. Y. Ent. Soc., XX, 123, 1912. Five paratypes.

Belocephalus rehni *Davis*, Jour. N. Y. Ent. Soc., XX, 124, 1912. Three paratypes.

Timanthes superbus *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 196, 1909. One type.

Timanthes quadratus *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 198, 1909. One type.

Cymatomera orientalis *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 200, 1909. One type.

Ephippithyta biramosa *Rehn*, Bull. Am. Mus. Nat. Hist., XXIII, 455, 1907. One type.

Holochlora prasina *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 193, 1909. One type.

Isopsera scalaris *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 195, 1909. One type.

Scudderia fasciata *Beut.*, Bull. Am. Mus. Nat. Hist., VI, 251, 1894. One type. Though this species was described from three males and three females in the collection of the Museum only a single specimen so labelled can at present be found. Four additional females of the same species and bearing similar data to that on the type specimen are in the collection but it is uncertain which if any of these are types.

Scudderia truncata *Beut.*, Bull. Am. Mus. Nat. Hist., VI, 252, 1894. We are unable to discover the single male specimen from which this species was described. It is not in its place in the collection; nor does it appear to be in any of the miscellaneous small collections not as yet incorporated into the general collection.

Neduba carinata var. **convexa** *Caudell*, Proc. U. S. Nat. Mus., XXXII, 306, 1907. One type and one cotype.

Eremopedes brevicauda *Caudell*, Proc. U. S. Nat. Mus., XXXII, 336, 1907. One type.

Family Locustidæ.

Orphulella graminea *Bruner*, Biol. Centr.-Am., Orthop., II, 78, 1904. Two cotypes.

Orphulella olivacea *Morse*, Psyche, VI, 477, 1893. Six types.

Scyllina pratensis *Bruner*, Biol. Centr.-Am., Orthop., II, 100, 1904. Two cotypes.

Scyllina brasiliensis *Bruner*, Biol. Centr.-Am., Orthop., II, 100, 1904. Two cotypes.

Cryptobothrus chrysophorus *Rehn*, Bull. Am. Mus. Nat. Hist., XXIII, 444, 1907. One type.

Chortoicetes affinis *Rehn*, Bull. Am. Mus. Nat. Hist., XXIII, 445, 1907. One type.

Chortoicetes pusillulus *Rehn*, Bull. Am. Mus. Nat. Hist., XXIII, 447, 1907. One type.

Arphia saussureana *Bruner*, Proc. U. S. Nat. Mus., XII, 63, 1890. Two cotypes.

Spharagemon æquale scudderi *Morse*, Proc. Bost. Soc. Nat. Hist., XXVI, 225, 1894. Four types.

Spharagemon saxatile *Morse*, Proc. Bost. Soc. Nat. Hist., XXVI, 229, 1894. Four types.

Eoscyllina inexpectata *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 187, 1909. One type.

Desmoptera sundiaca *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 188, 1909. One type.

Atractomorpha australis *Rehn*, Bull. Am. Mus. Nat. Hist., XXIII, 449, 1907. One type.

Tropinotus (Diedronotus) gracilis *Bruner*, Ent. News, XVI, 216, 1905. Two cotypes.

Quilta pulchra *Rehn*, Bull. Am. Mus. Nat. Hist., XXVI, 190, 1909. One type.

Chrysopsacris (Inusia) inornatipes *Bruner*, Biol. Centr.-Am., Orthop., II, 260, 1908. One cotype.

Anniceris meridionalis *Bruner*, Biol. Centr.-Am., Orthop., II, 271, 1908. Two cotypes.

Omalotettix (Abracris) signatipes *Bruner*, Proc. U. S. Nat. Mus., XXX, 673, 1906. One cotype.

Omalotettix (Abracris) meridionalis *Bruner*, Biol. Centr.-Am., Orthop., II, 281, 1908. Two cotypes.

Leptomerinthophora smaragdipes *Bruner*, Biol. Centr.-Am., Orthop., II, 287, 1908. Two cotypes.

Sitalces ovatipennis *Bruner*, Biol. Centr.-Am., Orthop., II, 292, 1908. Two cotypes.

Azelota diversipes *Rehn*, Bull. Am. Mus. Nat. Hist., XXIII, 450, 1907. Two types.

Exarna rugosa *Rehn*, Bull. Am. Mus. Nat. Hist., XXIII, 452, 1907. One type.

Macrotona gracilis *Rehn*, Bull. Am. Mus. Nat. Hist., XXIII, 453, 1907. One type.

Paratylotropidia beutenmuelleri *Morse*, Psyche, XIV, 14, 1907. One type.

Melanoplus herbaceus *Bruner*, Bull. U. S. Dept. Agri., Ent., XXVIII, 25, 1893. Two cotypes.

Melanoplus fluviatilis *Bruner*, Ann. Rept. Ent., Nebraska State Bd. Agric., 136, 1896. One cotype.

Order HEMIPTERA.

Family Cicadidæ.

Cicada sayi *Gross.*, Ent. News, XVIII, 124. Five cotypes.

Cicada linnei *Gross.*, Ent. News, XVIII, 127. Three cotypes.

Family Coccidæ.

Amorphococcus mesuæ *Green*, Ent. Month. Mag., XXXVIII, 261, 1902. One cotype of gall on twig.

Kermes kingii *Ckll.*, Ann. Mag. Nat. Hist., (7) II, 330, 1898. One type on slide.

Cryptokermes brasiliensis *Hempel*, Rev. Mus. Paul., IV, 398, 1900. One cotype and another specimen marked "part of type."

Phenacoccus acericola *King*, Can. Ent., XXXIV, 211, 1902. One cotype on slide.

Phenacoccus cockerelli *King*, Can. Ent., XXXV, 195, 1903. Several cotypes, loose and on twigs.

Phenacoccus dearnessi *King*, Can. Ent., XXXIII, 180, 1901. One type on slide.

Pseudococcus claviger *King and Tinsley*, Psyche, VIII, 150, 1897. Several cotypes once obviously in alcohol but now dried.

Pseudococcus cockerelli *King and Tinsley*, Psyche, VIII, 297, 1898. Several cotypes in alcohol and one on slide.

Dactylopius (Pseudococcus) kingii *Ckll.*, Science Gossip, n. s., III, 248, 1896. One cotype on slide.

Ripersia flaveola *Ckll.*, Can. Ent., XXVIII, 224, 1896. Several cotypes in alcohol and one on slide.

Ripersia kingii *Ckll.*, Can. Ent., XXVIII, 222, 1896. One cotype on slide.

Ripersia lasii *Ckll.*, Can. Ent., XXVIII, 223, 1896. Several cotypes obviously once in alcohol but now dried, and one on slide.

Tackardia glomerella *Ckll.*, Ent. News, XVI, 52, 1905. Several specimens on twig marked "part of type."

Pulvinaria cockerelli *King*, Psyche, VIII, 417, 1899. Several cotypes on leaves.

Pulvinaria erhorni *King*, Can. Ent., XXXIII, 145, 1901. Several cotypes, loose and on twigs.

Pulvinaria tiliæ *King and Ckll.*, Psyche, VIII, 286, 1898. Several cotypes.

Pulvinaria tinsleyi *King*, Can. Ent., XXXII, 360, 1900. Several dry specimens marked "part of original lot."

Pulvinaria vinifera *King*, Mittl. Schweiz. Ent. Ges., X, 481, 1903. Two cotypes on slide. The specific name on the type label is erroneously spelled [illegible].

Pulvinaria simplex *King*, Mittl. Schweiz. Ent. Ges., X, 475, 1902. Several cotypes. The type label bears the generic name *Eulecanium*.

Ceroplastes candela *Ckll. and King*, Entomologist, XXXV, 113, 1902. Two cotypes.

Ceroplastes schrottkyi *Ckll.*, Ent. News, XVI, 162, 1905. Two specimens marked "part of types."

Eulecanium fraxini *King*, Can. Ent., XXXIV, 158, 1902. Several cotypes, loose and on twig.

Eulecanium guignardi *King*, Can. Ent., XXXIII, 334, 1901. Several cotypes.

Eulecanium rosæ *King*, Can. Ent., XXXIII, 336, 1901. Several cotypes.

Lecanium (Eulecanium) hoferi *King*, Mittl. Schweiz., Ent. Ges., X, 478, 1903. Several cotypes.

Lecanium (Eulecanium) pulchrum *King*, Allg. Zeits. f. Ent. VIII, 410, 1903. Several cotypes. The name on the type label is written *Eulecanium pulchristæ*.

Lecanium (Eulecanium) kingii *Ckll.*, Ann. Mag. Nat. Hist., (7) II, 322, 1898. Several cotypes on twigs.

Lecanium (Eulecanium) pallidior *Ckll.* and *King*, Psyche, VIII, 350, 1899. Two cotypes on twigs.

Lecanium (Eulecanium) rehi *King*, Jahrb. Hamb. Wiss. Anst., XVIII, 5, 1900. Several cotypes, loose, and one on slide.

Lecanium (Eulecanium) websteri *King*, Can. Ent., XXXIII, 106, 1901. Several cotypes on twig and one on slide.

Saissetia nigrella *King*, Psyche, IX, 296, 1902. Several cotypes.

Chionaspis furfurus var. **fulvus** *King*, Psyche, VIII, 334, 1899. Several cotypes on twigs.

Chionaspis gleditsiæ *Sanders*, Ohio Naturalist, III, 413, 1903. Several cotypes on twigs.

Chionaspis sylvatica *Sanders*, Ohio Naturalist, IV, 95, 1904. Several cotypes on twig.

Aspidiotus coniferarum var. **shastæ** *Coleman*, Jour. N. Y. Ent. Soc., XI, 67, 1903. Several cotypes on twigs.

Aspidiotus osborni *Newell and Ckll.*, Rept. Iowa Acad. Sci., V, 229, 1898. Several cotypes on twig.

Aspidiotus piceus *Sanders*, Ohio Naturalist, IV, 96, 1904. Several cotypes on twig.

Aspidiotus (**Chrysomphalus**) **paulistus** *Hempel*, Rev. Mus. Paul., IV, 504, 1900. Several cotypes on leaf, and leaf with several other specimens marked " part of type."

Aspidiotus (**Chrysomphalus**) **kelloggii** *Kuana*, Proc. Cal. Acad. Sci., (3) III, 71, 1902. Several cotypes on twig.

Cyrptophyllaspis liquidambaris *Kotinsky*, Proc. Ent. Soc. Wash., V, 149, 1897. Several cotypes on leaf.

Stictococcus sjostedti *Ckll.*, Can. Ent., XXXV, 64, 1903. Two specimens on slide marked " one of type lot."

Family NOTONECTIDÆ.

Notonecta raleighi *Bueno*, Can. Ent., XXXIX, 225, 1907. Two types.

Family HENICOCEPHALIDÆ.

Henicocephalus ærius *Bergroth*, MS. One type.

Family REDUVIIDÆ.

Piestolestes lineatus *Bergroth*, MS. One type.

Hermillus edo *Bergroth*, MS. One type.

Stenolæmus edwardsii *Bergroth*, MS. Two types.

Family NAUCORIDÆ.

Pelocoris carolinensis *Bueno*, Can. Ent., XXXIX, 227, 1907. Two types.

Family MIRIDÆ.

Lygus neovalesicus *Bergroth*, MS. Two types.

Family LYGÆIDÆ.

Emblethis vicarius *Horvath*, Ann. Mus. Nat. Hist. Hung., VI, 563, 1908. One cotype.

Family Coreidæ.

Hyocephalus aprugnus *Bergroth*, MS. One type (brachypterous form).

Family Pentatomidæ.

Chlorochroa (Pentatoma) persimilis *Horvath*, Ann. Mus. Nat. Hist. Hung., VI, 555, 1908. One cotype.

Platycoris scutellatus *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 190, 1905. One type.

Platycoris rufescens *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 191, 1905. One type.

Pœcilometis stigmatus *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 198, 1905. One type.

Pœcilometis edwardsi *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 198, 1905. Two types.

Menestheus brevis *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 200, 1905. One type.

Dictyotus pallidus *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 203, 1905. Two types.

Antestia oliva *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 206, 1905. One type.

Opines geminata *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 206, 1905. One type.

Cuspicona carneola *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 207, 1905. One type.

Cuspicona beutenmulleri *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 208, 1905. One type.

Andriscus cinctus *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 213, 1905. One type.

Andriscus terminalis *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 213, 1905. One type.

Stictocarenus subrufescens *Van Duzee*, Bull. Am. Mus. Nat. Hist., XXI, 214, 1905. One type.

Order COLEOPTERA.

Family Cicindelidæ.

Omus edwardsii *Crotch*, Trans. Am. Ent. Soc., V, 73, 1874. Two types.

Omus sequoiarum *Crotch*, Trans. Am. Ent. Soc., V, 73, 1874. One cotype.

Family Carabidæ.

Cychrus viduus var. **irregularis** *Beut.*, Bull. Am. Mus. Nat. Hist., XIX, 513, 1903. Three types.

Cychrus æneicollis *Beut.*, Bull. Am. Mus. Nat. Hist., XIX, 515, 1903. Fourteen types.

Nomaretus debilis var. **alpinus** *Beut.*, Bull. Am. Mus. Nat. Hist., XIX, 512, 1903. Three types.

Trechus carolinæ *Schæffer*, Bull. Am. Mus. Nat. Hist., XIV, 212, 1901. One type.

Platynus trifoveolatus *Beut.*, Bull. Am. Mus. Nat. Hist., XIX, 516, 1903. One type.

Platynus gracilentus *Beut.*, Bull. Am. Mus. Nat. Hist., XIX, 517, 1903. Sixteen types.

Family PARNIDÆ.

Elmis columbiensis *Angell*, Ent. News, III, 84, 1892. One type, two cotypes.

Family ELATERIDÆ.

Corymbites weidtii *Angell*, Ent. News, III, 84, 1892. One type, four cotypes.

Family BUPRESTIDÆ.

Chrysobothris edwardsii *Horn*, Trans. Am. Ent. Soc., XIII, 74, 1886. One type.

Chrysobothris nixa *Horn*, Trans. Am. Ent. Soc., XIII, 98, 1886. One type.

Chrysobothris cyanella *Horn*, Trans. Am. Ent. Soc., XIII, 102, 1886. One type, two cotypes.

Family SCARABAEIDÆ.

Trox gemmulatus *Horn*, Trans. Am. Ent. Soc., V, 8, 1874. Three cotypes.

Plusiotus beyeri *Skinner*, Ent. News, XVI, 289, 1905. One cotype.

Family CERAMBYCIDÆ.

Molorchus longicollis *Leconte*, Smith. Miscell. Coll., XI, paper 264, p. 193, 1874. One type.

Anthophilax hoffmanii *Beut.*, Bull. Am. Mus. Nat. Hist., XIX, 518, 1903. Three types.

Megacriodes (Batocera) guttata *Voll.*, Tidj. v. Ent., XIV, 110, 1871. One cotype.

Family BRUCHIDÆ.

Bruchus fabæ *Riley*, Third Ann. Rept. Ins. Mo., 52, 1871. Two types. These specimens bear the following label written apparently in Riley's hand, "Bruchus fabæ Riley, original." They are without locality label or other data save an Osten-Sacken collection label. The species was described from many specimens and we infer that these came from the original lot and are therefore types.

Family MELOIDÆ.

Epicauta alastor *Skinner*, Ent. News, XV, 217, 1904. Three cotypes.

Cantharis pilsbryi *Skinner*, Ent. News, XVII, 217, 1906. One cotype.

Colospasta wenzeli *Skinner*, Ent. News, XV, 217, 1904. Four cotypes.

Tegrodera aloga *Skinner*, Ent. News, XIV, 168, 1903. One cotype.

Order HYMENOPTERA.

Family CYNIPIDÆ.

Dryophanta polita *Bass.*, Can. Ent., XIII, 99, 1881. One type of adult.

Dryophanta pedunculata *Bass.*, Trans. Am. Ent. Soc., XVII, 72, 1890. Two types of adult.

Cynips (Holcaspis) quercus-mamma *Walsh and Riley*, Am. Ent., I, 162, 1869. One type of gall, pinned.

Cynips (Andricus) pattoni *Bass.*, Can. Ent., XIII, 98, 1881. Four types of gall, pinned.

Cynips (Andricus) quercus-medullæ *Ashm.*, Trans. Ent. Soc. Am. XII, Proc. p. VIII, 1885. Several cotypes of gall, pinned.

Cynips (Andricus) quercus-formosa *Bass.*, Proc. Ent. Soc. Phila., III, 679, 1864. Three types of gall, pinned.

Cynips (Dryophanta) papula *Bass.*, Can. Ent., XIII, 107, 1881. One type of gall, pinned.

Holcaspis rubens *Gill.*, Ent. News, IV, 29, 1893. One type of adult.

Holcaspis monticola *Gill.*, Ent. News, IV, 30, 1893. One type of adult.

Holcaspis brevipennata *Gill.*, Ent. News, IV, 31, 1893. One type of adult.

Acraspis undulata *Gill.*, Ent. News, IV, 28, 1893. One type of adult.

Andricus pruinosus *Bass.*, Trans. Am. Ent. Soc., XXVI, 311, 1900. Four types of adult, and many of gall on twigs and bits of leaves, pinned.

Andricus kingi *Bass.*, Trans. Am. Ent. Soc., XXVI, 316, 1900. Six types of gall, pinned.

Andricus perditor *Bass.*, Trans. Am. Ent. Soc., XXVI, 318, 1900. Three types of gall, pinned.

Andricus texanus *Beut.*, Ent. News, XX, 248, 1909. Four types of adult and nine of gall, pinned.

Andricus aciculatus *Beut.*, Ent. News, XX, 247, 1909. Five types of adult and one of gall, pinned.

Andricus howertoni *Bass.*, Trans. Am. Ent. Soc., XVII, 82, 1890. One type of gall, pinned.

Andricus coronus *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 464, 1907. Four types of adult.

Andricus wheeleri *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 464, 1907. Three types of adult and two of gall, pinned.

Andricus davisi *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 463, 1907. Twelve types of adult and many of gall, pinned.

Callirhyctis pustulatoides *Bass.*, Trans. Am. Ent. Soc., XVII, 74, 1890. Two types of gall. The specific name on the type label is spelled *pustuloides*, but the specimens agree well with Basset's description of the species.

Amphibolips melanocera *Ashm.*, Trans. Am. Ent. Soc., XII, 299, 1885. One adult bearing note " cut from type gall."

Antistrophus rufus *Gill.*, Bull. Ill. State Lab. Nat. Hist., III, 195, 1890. Six adults bearing note " cut from type galls."

Antistrophus leavenworthi *Bass.*, Trans. Am. Ent. Soc., XXVI, 310, 1900. Seven types of adult.

Diastrophus niger *Bass.*, Trans. Am. Ent. Soc., XXVI, 324, 1900. One type of adult and two of gall.

Diastrophus minimus *Bass.*, Trans. Am. Ent. Soc. XXVI, 325, 1900. One type of adult and one of gall.

Synergus atripes *Gill.*, Trans. Am. Ent. Soc., XXIII, 96, 1896. Two types of adult.

Synergus incisus *Gill*, Trans. Am. Ent. Soc., XXIII, 92, 1896. Two types of adult.

Synergus punctata *Gill.*, Trans. Am. Ent. Soc., XXIII, 94, 1896. Two types of adult.

Synergus erinacei *Gill.*, Trans. Am. Ent. Soc., XXIII, 94, 1896. Two types of adult.

Aulax chrysothamni *Beut.*, Jour. N. Y. Ent. Soc., XVI, 45, 1908. Two types of adult and four of gall, pinned.

Rhodites nodulosus *Beut.*, Ent. News, XX, 247, 1909. Five types of adult and nine of gall, pinned.

Rhodites gracilis *Ashm.*, Proc. U. S. Nat. Mus., XIX, 135, 1897. One type of gall, pinned.

Rhodites nebulosus *Bass.*, Trans. Am. Ent. Soc., XVII, 63, 1890. One type of gall, pinned.

Rhodites arefactus *Gill.*, Can. Ent., XXVI, 157, 1894, One type of adult and one of gall.

Rhodites globuloides *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 638, 1897. Two types of adult and many of gall on twigs, unpinned.

There are a number of other galls in the collection labelled as types with museum type labels but there is no name attached to show what they are types of. There are also " types " of a few other species the descriptions of which seem never to have been published. These manuscript types are not recorded in the present enumeration.

Family EVANIIDÆ.

Evania urbana *Bradley*, Trans. Am. Ent. Soc., XXXIV, 141, 1908. Two paratypes.

Acanthinevania szepligeti *Bradley*, Trans. Am. Ent. Soc., XXXIV, 176, 1908. One type. This species was described under the above generic term but the type label bears the name *Megalyra*. The unique type, also, on which the name is based is, in the description, said to be in the collection of Cornell University. There is no doubt, however, but that the type in the Museum is the original one.

Family CHALCIDIDÆ.

Ænasius cæruleus *Brues*, Bull. Am. Mus. Nat. Hist., XXVIII, 84, 1910. One type.

Anusioptera aureocincta *Brues*, Bull. Am. Mus. Nat. Hist., XXVIII, 83, 1910. One type.

Pheidoloxenes wheeleri *Ashmead*, Bull. Am. Mus. Nat. Hist., XXIII, 1
Eleven cotypes. The genus *Pheidoloxenes* is diagnosed by Ashmead in Vo
28, of the Memoirs of the Carnegie Museum, and *wheeleri* is cited as type

specific name is only given standing in Wheeler's paper on 'The Polymorphism of Ants' (Bull. Am. Mus. Nat. Hist., XXIII, 17) where in addition to an adequate description a figure (pl. iii, f. 36) of the species is given. The species is credited by Wheeler to Ashmead.[1]

Family Proctotrupidæ.

Idris quadrispinosus *Brues*, Bull. Am. Mus. Nat. Hist., XXVIII, 80, 1910. One type.

Opisthacanthus striativentrus *Brues*, Bull. Am. Mus. Nat. Hist., XXVIII, 81, 1910. Two types.

Dryinus nigrellus *Brues*, Can. Ent., XXXVI, 117, 1904. One type.

Oxylabis bifoveolatus *Brues*, Can. Ent. XXXVI, 119, 1904. One type.

Family Platygasteridæ.

Metanopedius sicarius *Brues*, Bull. Am. Mus. Nat. Hist., XXVIII, 79, 1910.

Dolichotrypes hopkinsi *Crawford and Bradley*, Proc. Ent. Soc. Wash., XIII, 124, 1911. Two paratypes.

Family Sphegidæ.

Mimesa myersiana *Rohwer*, Ent. News, XX, 324, 1909. Two cotypes.

Eucerceris angulata *Rohwer*, Bull. Am. Mus. Nat. Hist., XXXI, 326, 1912. One type.

Steniolia sulphurea *Fox*, Jour. N. Y. Ent. Soc., IX, 84, 1901. Two types.

Bembex beutenmulleri *Fox*, Jour. N. Y. Ent. Soc., IX, 83, 1901. Four types.

Family Apidæ.

Halictus synthyridis *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 427, 1906. Two types.

Halictus scrophulariæ *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 428, 1906. One cotype.

Parasphecodes tilachiformis *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 234, 1907. One type.

Andrena cyanophila *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 431, 1906. One cotype.

Andrena vicina argentiniæ *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 432, 1906. One cotype.

Andrena micranthophila *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 432, 1906. One cotype.

Andrena runcinatæ *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 434, 1906. One cotype.

Andrena lewisii *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 435, 1906. One cotype.

Andrena synthyridis *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 436, 1906. One cotype.

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[1] I am indebted to Dr. Wheeler for calling my attention to the reference in his paper.

Andrena lappulæ *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 437, 1906. One cotype.

Andrena winkleyi *Viereck*, Ent. News, XVIII, 283, 1907. Two paratypes.

Andrena braccata *Viereck*, Ent. News, XVIII, 284, 1907. Two paratypes.

Andrena weedi *Viereck*, Ent. News, XVIII, 284, 1907. One paratype.

Andrena mustelicolor huardi *Viereck*, MS. One paratype.

Andrena cheyenneorum *Viereck*, MS. One type.

Andrena idahorum *Viereck*, MS. One type.

Andrena beutenmulleri *Viereck*, MS. One type.

Andrena edwardsii *Viereck*, MS. Three types.

Andrena huntingtoni *Viereck*, MS. One paratype.

Andrena alleghenyensis *Viereck*, MS. One paratype.

Nomia amboinensis *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 234, 1907. One type.

Perdita florissantella *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 440, 1906. One cotype.

Perdita tortifoliæ *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 440, 1906. One cotype.

Perdita wilmattæ *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 441, 1906. Two cotypes.

Nomada rohweri *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 438, 1906. One cotype.

Crocisa macleayi *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 232, 1907. One type.

Melissodes hymenoxidis *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 443, 1906. One cotype.

Anthophora wallacei *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 226, 1907. One type.

Colletes polemonii *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 425, 1906. One cotype.

Titusella pronitens *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 446, 1906. One cotype.

Megachile giliæ *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 452, 1906. One cotype.

Megachile wootoni rohweri *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 453, 1906. One cotype.

Megachile macleayi *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 222, 1907. One type.

Megachile beutenmulleri *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 222, 1907. One type.

Megachile henrici *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 223, 1907. One type.

Megachile maculariformis *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 223, 1907. One type.

Megachile devadatta *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 224, 1907. One type.

Megachile doleschalli *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 224, 1907. One type.

Megachile dampieri *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 225, 1907. One type.

Megachile funnelli *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 226, 1907. One type.

Osmia cyaneonitens *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 448, 1906. One cotype.

Osmia chlorops *Ckll. and Titus*, Bull. Am. Mus. Nat. Hist., 448, 1906. One cotype.

Osmia wheeleri *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 449, 1906. One cotype.

Osmia florissanticola *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 450, 1906. One cotype.

Osmia albolateralis *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 450, 1906. One cotype.

Osmia pentstemonis *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 451, 1906. One cotype.

Osmia gilliarum *Ckll.*, Bull. Am. Mus. Nat. Hist., XXII, 451, 1906. One cotype.

Euryglossa edwardsii *Ckll.*, Bull. Am. Mus. Nat. Hist., 230, 1907. One type.

Euryglossa fasciatella *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 230, 1907. One type.

Goniocolletes morsus *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 231, 1907. One type.

Xylocopa chionothorax *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 228, 1907. One type.

Xylocopa mohnikei *Ckll.*, Bull. Am. Mus. Nat. Hist., XXIII, 228, 1907. One type.

Bombus soroensis quattricolor *Krausse*, Intern. Ent. Zeitschr., II, 133, 1908. One type.

Bombus pratorum aureus *Krausse*, Intern. Ent. Zeitschr., II, 133, 1908. One type.

Bombus terrestris dettoi *Krausse*, Intern. Ent. Zeitschr., II, 132, 1908. One type.

Bombus terrestris limbaræ *Krausse*, Ent. Wochenbl., XXV, 78, 1908. One type.

Bombus terrestris galluræ *Krausse*, Ent. Wochenbl., XXV, 78, 1908. One type.

Bombus terrestris duplex *Krausse*, Soc. Ent., Zürich, XXIII, 186, 1909. One type.

Bombus terestris ruber *Krausse*, Soc. Ent., Zürich, XXIII, 185, 1909. One type.

Bombus terrestris simplex *Krausse*, Soc. Ent., Zürich, XXIII, 186, 1909. One type.

Bombus terrestris tener *Krausse*, Soc. Ent., Zürich, XXIII, 186, 1909. One type.

Bombus lapponicus pulchrior *Krausse*, Ent. Wochenbl., XXV, 76, 1908. One type.

Bombus hortorum arborensis *Krausse*, Intern. Ent. Zeitschr., II, 139, 1908. One type.

Bombus hortorum wolffi *Krausse*, Ent. Wochenbl., XXV, 94, 1908. One type.

Bombus hortorum ichnusæ *Krausse,* Ent. Wochenbl., XXV, 174, 1908. One type.

Bombus hortorum hæckeli *Krausse,* Ent. Wochenbl., XXV, 174, 1908. One type.

Bombus hortorum fertoni *Krausse,* Soc. Ent., Zurich, XXIV, 86, 1909. One type.

Bombus hortorum eleonoræ *Krausse,* Intern. Ent. Zeitschr., III, 15, 1909. One type.

Order DIPTERA.

Family TIPULIDÆ.

Atarba puella *Will.,* Trans. Ent. Soc. Lond., 288, 1896. Three types, two in very poor condition.

Teucholabis annulata *Will.,* Trans. Ent. Soc. Lond., 290, 1896. Two types.

Mongoma manca *Will.,* Trans. Ent. Soc. Lond., 293, 1896. One type.

Eriocera austera *Doane,* Jour. N. Y. Ent. Soc., VIII, 192, 1900. One type.

Eriocera fasciata *Will.,* Biol. Centr.-Am., Dipt. I, 226, 1900. One cotype.

Tipula sulphurea *Doane,* Jour. N. Y. Ent. Soc., IX, 99, 1901. One type.

Tipula carinata *Doane,* Jour. N. Y. Ent. Soc., IX, 103, 1901. Two types.

Tipula retusa *Doane,* Jour. N. Y. Ent. Soc., IX, 109, 1901. One type.

Tipula acuta *Doane,* Jour. N. Y. Ent. Soc., IX, 116, 1901. One type.

Family PSYCHODIDÆ.

Pericoma albitarsis *Will.,* Trans. Ent. Soc. Lond., 284, 1896. Two types.

Family CHIRONOMIDÆ.

Ceratopogon flavus *Will.,* Trans. Ent. Soc. Lond., 280, 1896. Three types.

Chironomus anonymous *Will.,* Trans. Ent. Soc. Lond., 274, 1896. One type.

Chironomus longimanus *Will.,* Trans. Ent. Soc. Lond., 274, 1896. One type.

Family CULICIDÆ.

Culex sylvicola *Gross.,* Can. Ent., XXXVIII, 27, 1906. Three cotypes.

Culex pretans *Gross.,* Ent. News, XV, 332, 1904. One cotype.

Aedes pertinans *Will.,* Trans. Ent. Soc. Lond., 271, 1896. Two types.

Hæmagogus splendens *Will.,* Trans. Ent. Soc. Lond., 272, 1896. Two types.

Family MYCETOPHILIDÆ.

Platyura genualis *Johan.,* Bull. 172, Maine Agri. Exper. Sta., 262, 1910. Three cotypes.

Macrocera concinna *Will.,* Trans. Ent. Soc. Lond., 255, 1896. Two types.

Sciophila glabana var. **germana** *Johan.,* Bull. 180, Maine Agri. Exper. Sta., 137, 1910. Two cotypes.

Sciophila nugax *Johan.,* Bull. 180, Maine Agri. Exper. Sta., 137, 1910. One cotype.

Sciophila impar *Johan.*, Bull. 180, Maine Agri. Exper. Sta., 140, 1910. Three cotypes.

Polylepta obediens *Johan.*, Bull. 180, Maine Agri. Exper. Sta., 147, 1910. One cotype.

Neoempheria indulgens *Johan.*, Bull. 180, Maine Agri. Exper. Sta., 162, 1910. One cotype.

Mycomyia littoralis var. **frequens** *Johan.*, Bull. 180, Maine Agri. Exper. Sta., 171, 1910. Three cotypes.

Mycomyia imitans *Johan.*, Bull. 180, Maine Agri. Exper. Sta., 177, 1910. Five cotypes.

Mycomyia sigma *Johan.*, Bull. 180, Maine Agri. Exper. Sta., 180, 1910. One type.

Mycomyia nugatoria *Johan.*, Bull. 180, Maine Agri. Exper. Sta., 182, 1910. One cotype.

Mycomyia recurva *Johan.*, Bull. 180, Maine Agri. Exper. Sta., 185, 1910. One cotype.

Mycomyia recurva var. **chloratica** *Johan.*, Bull. 180, Maine Agri. Exper. Sta., 185, 1910. One type.

Gnoriste macra *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 257, 1911. One cotype.

Boletina melancholica *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 271, 1911. One cotype.

Boletina gracilis *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 271, 1911. Four cotypes.

Boletina notescens *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 272, 1911. One cotype.

Boletina delicata *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 276, 1911. One type.

Boletina nacta *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 277, 1911. Three cotypes.

Leia plebeja *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 285, 1911. One cotype.

Leia dryas *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 287, 1911. One type.

Neoglaphyroptera (Leia) nitens *Will.*, Trans. Ent. Soc. Lond., 259, 1896. One type.

Coelosia gracilis *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 294, 1911. One cotype.

Coelosia lepida *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 294, 1911. One type.

Coelosia modesta *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 294, 1911. One cotype.

Rhymosia imitator *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 312, 1911. One cotype.

Rhymosia akeleyi *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 312, 1911. One type.

Allodia falcata *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 317, 1911. Five cotypes.

Allodia delita *Johan.*, Bull. 196, Maine Agri. Exper. Sta., 320, 1911. One cotype.

Exechia perspicua *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 67, 1912. One cotype.

Exechia quadrata *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 69, 1912. Four cotypes.

Exechia nugatoria *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 70, 1912. One cotype.

Exechia palmata *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 71, 1912. Two cotypes.

Exechia auxiliaria *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 71, 1912. Two cotypes.

Exechia bella *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 72, 1912. Two cotypes.

Exechia capillata *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 73, 1912. Three cotypes.

Exechia obediens *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 73, 1912. One cotype.

Exechia attrita *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 73, 1912. Three cotypes.

Exechia casta *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 74, 1912. Nine cotypes.

Mycothera mitis *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 82, 1912. One type.

Mycothera fenestrata var. **prænubila** *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 83, 1912. Two cotypes.

Mycetophila perita *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 90, 1912. One cotype.

Mycetophila anomala *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 96, 1912. Three cotypes.

Mycetophila fœcunda *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 99, 1912. One cotype.

Mycetophila imitator *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 99, 1912. One cotype.

Mycetophila lenta *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 102, 1912. One cotype.

Mycetophila endura *Johan.*, Bull. 200, Maine Agri. Exper. Sta., 103, 1912. One cotype.

Mycetophila dolosa *Will.*, Trans. Ent. Soc. Lond., 264, 1896. Two types.

Sciara concinna *Will.*, Trans. Ent. Soc. Lond., 266, 1896. Four types.

Sciara germana *Will.*, Trans. Ent. Soc. Lond., 266, 1896. Two types.

Sciara debilis *Will.*, Trans. Ent. Soc. Lond., 266, 1896. One type.

Sciara zygoneura *Will.*, Trans. Ent. Soc. Lond., 267, 1896. Two types.

Family CECIDOMYIDÆ.

Lasioptera tumifica *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 394, 1907. Thirty-one types of adult and four of gall, pinned.

Lasioptera cornicola *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 394, 1907. Sixteen types of adult and four of gall, pinned. Thirteen twigs with galls, unpinned.

Lasioptera asterifoliæ *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 395, 1907. Ten types of adult. *Acerifoliæ* instead of *asterifoliæ* is written on the type label.

Lasioptera nodulosa *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 397, Nine types of adult and four of gall, pinned. Twenty twigs with galls, unpin

Lasioptera viburnicola *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 398, 1907. Twenty-two types of adult and three of gall.

Lasioptera linderæ *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 398, 1907. Four types of adult and ten of gall, pinned. Numerous twigs with galls, unpinned.

Asphondylia mentzeliæ *Ckll.*, Entomologist, XXXIII, 302, 1900. Two galls labelled "part of type lot."

Asphondylia betheli *Ckll.*, Can. Ent., XXXIX, 324, 1907. Two adults and one gall labelled "from type lot."

Asphondylia autumnalis *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 386, 1907. Ten types of adult.

Asphondylia patens *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 386, 1907. Three types of adult.

Rhopalomyia betheliana *Ckll.*, Can. Ent., XLI, 158, 1909. Four types of gall carded on one pin. Three adults are associated with these galls and may also be types but they are not so labelled.

Cecidomyia clavula *Beut.*, Bull. Am. Mus. Nat. Hist., IV, 269, 1892. Four types of adult.

Cecidomyia ulmi *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 387, 1907. Fifteen types of adult.

Cecidomyia nyssæcola *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 387, 1907. Two types of adult.

Cecidomyia unguicula *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 388, 1907. Seven types of adult and two of gall, pinned.

Cecidomyia rudbeckiæ *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 388, 1907. Six types of adult, and eight of gall, pinned.

Cecidomyia chinquapin *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 389, 1907. One type gall.

Cecidomyia vernoniæ *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 389, 1907. Four type galls, pinned, and others unpinned are labelled with this name; six other galls of apparently the same species are labelled as types of "*Lasioptera*" *vernoniæ* and with these are associated three "types" of adults. The species was described from the larva and gall only, so whether these latter "types" prove to be the same species or not the adults at least cannot be types.

Cecidomyia meibomiæ *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 390, 1907. Ten galls pinned, and numerous others unpinned, are labelled types; in addition thirty-nine adults under the label "*Hormomyia*" *meibomiæ* are marked as types. The species was described from the larva and gall alone, and whether these adults were bred from the type galls or not they cannot stand as types in the ordinary sense of the word.

Cecidomyia pustuloides *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 390, 1907. Several type galls on fragments of leaves, pinned.

Cecidomyia ramuscula *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 392, 1907. Eleven types of gall, pinned.

Cecidomyia lysimachiæ *Beut.*, Can. Ent., XXXIX, 305, 1907. Nineteen types of adult and seven of gall.

Cecidomyia verbenæ *Beut.*, Can. Ent. XXXIX, 306, 1907. Six types of adult, one of gall, pinned, and six twigs with type galls.

Cecidomyia meibomiifoliæ *Beut.*, Can. Ent., XXXIX, 306, 1907. Five types of adult and five of gall, pinned.

Cecidomyia myricæ *Beut.*, Can. Ent., XXXIX, 306, 1907. Thirty types of adult and thirteen of gall, pinned.

Cecidomyia semenivora *Beut.*, Bull. Am. Mus. Nat. Hist., XXIII, 390, 1907. Eighteen types of adult.

Diplosis (Cecidomyia) partheniicola *Ckll.*, Entomologist, XXXIII, 201, 1900. Several galls on a card labelled " part of type lot."

In addition to the types of Cecidomyidæ listed above there are in the collection a few other specimens labelled " types," but of what they are types there is no indication.

Family BIBIONIDÆ.

Plecia quadrivittata *Will.*, Biol. Centr.-Am., Dipt. I, 222, 1900. Two cotypes.

Bibiodes æstiva *Melander*, MS. Two types.

Bibiodes femorata *Melander*, MS. One type.

Family STRATIOMYIDÆ.

Hermetia ceriogaster *Will.*, Trans. Am. Ent. Soc., XV, 246, 1888. One type.

Analcocerus hortulanus *Will.*, Biol. Centr.-Am., Dipt. I, 238, 1900. One cotype.

Ptecticus concinnus *Will.*, Biol. Centr.-Am., Dipt. I, 238, 1900. Three cotypes.

Merosargus spatulatus *Will.*, Biol. Centr.-Am., Dipt. I, 234, 1900. Eight cotypes.

Merosargus gracilis *Will.*, Trans. Am. Ent. Soc., XV, 249, 1888. One type.

Merosargus concinnatus *Will.*, Biol. Centr.-Am., Dipt. I, 235, 1900. One cotype.

Chrysonotus analis *Will.*, Trans. Am. Ent. Soc., XV, 251, 1888. One type.

Chordonota nigra *Will.*, Trans. Am. Ent. Soc., XV, 255, 1888. One type.

Cyphomyia lasiophthalma *Will.*, Biol. Centr. Am., Dipt. I, 244, 1900.

Myxosargus braueri *Will.*, Trans. Am. Ent. Soc., XV, 254, 1888. Three types from " Corumba, Brazil." Williston in his description of the species says the types came from Chapada. I have no doubt he intended to write Corumba as the specimens labelled type are obviously the ones from which he drew up the description.

Euryneura elegans *Will.*, Trans. Am. Ent. Soc., XV, 252, 1888. One type.

Nemotelus wheeleri *Melander*, Psyche, IV, 182, 1903. One cotype.

Nemotelus bellulus *Melander*, Psyche, IV, 183, 1903. One cotype.

Nemotelus trinotatus *Melander*, Psyche, IV, 180, 1903. Two cotypes.

Nemotelus bruesi *Melander*, Psyche, IV, 179, 1903. Two cotypes.

Dicranophora astuta *Will.*, Trans. Am. Ent. Soc., XV, 250, 1888. Two types.

Dicranophora affinis *Will.*, Trans. Am. Ent. Soc., XV, 251, 1888. One type.

Promerisana cylindricornis *Will.*, Trans. Am. Ent. Soc., XV, 253, 1888. One type.

Family TABANIDÆ.

Pangonia filipalpis *Will.*, Kans. Univ. Quart., III, 190, 1895. Two types.

Pangonia arcuata *Will.*, Kans. Univ. Quart., III, 190, 1895. Two types.

Pangonia bullata *Will.*, Kans. Univ. Quart., III, 191, 1895. One type.

Pangonia pavida *Will.*, Biol. Centr.-Am., Dipt. I, 253, 1901. Eight cotyp

Chrysops intrudens *Will.*, Kans. Univ. Quart., III, 191, 1895. Four types.
Chrysops bistellatus *Daecke*, Ent. News, XVI, 249, 1905. One type.
Chrysops shermani *Hine*, Ohio Nat., VIII, 229, 1907. Two types.
Dichelacera scutellata *Will.*, Kans. Univ. Quart., III, 193, 1895. Four types.
Dichelacera pulchra *Will.*, Biol. Centr.-Am., Dipt. I, 263, 1901. One cotype.
Tabanus hyalinipennis *Hine*, Can. Ent., XXXV, 244, 1903. One type.
Tabanus pumiloides *Will.*, Biol. Centr.-Am., Dipt. I, 260, 1901. One cotype.
Tabanus hæmagogus *Will.*, Biol. Centr.-Am., Dipt. I, 261, 1901. One cotype.
Tabanus plenus *Hine*, Ohio Nat., VIII, 225, 1907. Four types.
Tabanus minusculus *Hine*, Ohio Nat., VIII, 226, 1907. Two types.
Tabanus longuisculus *Hine*, Ohio Nat., VIII, 226, 1907. Three types.
Hadrus parvus *Will.*, Kans. Univ. Quart., III, 192, 1895. Two types.

Family Leptidæ.

Dialysis aldrichii *Will.*, Kans. Univ. Quart., III, 265, 1895. Four types.
Chrysopila plebeia *Will.*, Biol. Centr.-Am., Dipt., I, 264, 1901. Four cotypes.

Family Cyrtidæ.

Pterodontia misella *Osten Sacken*, Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), III, 277, 1877. Mr. Beütenmuller in his list of types of Diptera, referring to the number of types in the collection says, "Two specimens." The two specimens in the collection are labelled respectively "Oregon" and "Alameda Co., Cal."; the former is marked "cotype"; the latter has nothing on it to indicate its being a type. The species was described from a single specimen from Oregon, and so our cotype is really a type while the second example is nothing more than a specimen.

Opsebius agelenæ *Melander*, Ent. News, XIII, 180, 1903. Two types.

Family Bombyliidæ.

Exoprosopa sackeni *Will.*, Biol. Centr.-Am., Dipt. I, 271, 1901. One cotype.

Exoprosopa brevirostris *Will.*, Biol. Centr.-Am., Dipt. I, 272, 1901. One cotype.

Anthrax edwardsii *Coq.*, Jour. N. Y. Ent. Soc., II, 102, 1894. Four types.
Anthrax diana *Will.*, Biol. Centr.-Am., Dipt. I, 280, 1901. Two cotypes.
Anthrax orbitalis *Will.*, Biol. Centr.-Am., Dipt. I, 281, 1901. Four cotypes.

Anthrax nigrofimbriata *Will.*, Biol. Centr.-Am., Dipt. I, 282, 1901. One cotype.

Anthrax maria *Will.*, Biol. Centr.-Am., Dipt. I, 283, 1901. Four cotypes.
Stonyx (Anthrax) lelia *Will.*, Biol. Centr.-Am., Dipt. I, 274, 1901. One cotype.

Pantarbes capito *Osten Sacken*, Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), III, 256, 1877. One cotype.

Bombylius clio *Will.*, Biol. Centr.-Am., Dipt. I, 285, 1901. Two cotypes.
Bombylius io *Will.*, Biol. Centr.-Am., Dipt. I, 285, 1901. Four cotypes.

Bombylius dolorosus *Will.*, Biol. Centr.-Am., Dipt. I, 286, 1901. Three cotypes.

Oncodocera analis *Will.*, Biol. Centr.-Am., Dipt. I, 283, 1901. Five cotypes.
Phthiria dolorosa *Will.*, Biol. Centr.-Am., Dipt. I, 290, 1901. One cotype.

Phthiria sororia *Will.*, Biol. Centr.-Am., Dipt. I, 291, 1901. Three cotypes.

Eclimus fascipennis *Will.*, Biol. Centr.-Am., Dipt. I, 1901. One cotype.

Epibates muricatus *Osten Sacken*, Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), III, 272, 1877. Two cotypes.

Family MYDAIDÆ.

Mydas cingulatus *Will.*, Trans. Kans. Acad. Sci., XV, 57, 1895. Though our single specimen was labelled " type " by Williston himself it is probably not a type. The species was described from " Rio Paraguay below Concepsion "; our specimen bears the locality label " Chapada."

Mydas clarifumis *Will.*, Trans. Kans. Acad. Sci., XV, 56, 1895. One Type.

Family ASILIDÆ.

Leptogaster triungulata *Will.*, Biol. Centr.-Am., Dipt. I, 299, 1901. One cotype.

Leptogaster concinnata *Will.*, Biol. Centr.-Am., Dipt. I, 300, 1901. One cotype.

Leptogaster crocea *Will.*, Biol. Centr.-Am., Dipt. I, 300, 1901. Four cotypes.

Leptogaster intima *Will.*, Biol. Centr.-Am., Dipt. I, 300, 1901. Five cotypes.

Leptogaster dorsalis *Will.*, Biol. Centr.-Am., Dipt. I, 301, 1901. Two cotypes.

Leptogaster micropygialis *Will.*, Biol. Centr.-Am., Dipt. I, 301, 1901. Five cotypes.

Damalis occidentalis *Will.*, Biol. Centr.-Am., Dipt. I, 309, 1901. One cotype. The specific name *fuscipennis* is written on the type label.

Townsendia niger *Back*, Trans. Am. Ent. Soc., XXXV, 175, 1909. One type.

Townsendia pulcherrima *Back*, Trans. Am. Ent. Soc., XXXV, 177, 1909. One type.

Dioctria vera *Back*, Trans. Am. Ent. Soc., XXXV, 256, 1909. One type.

Stichopogon abdominalis *Back*, Trans. Am. Ent. Soc., XXXV, 332, 1909. Three cotypes.

Saropogon pulcherima *Will.*, Biol. Centr.-Am., Dipt. I, 312, 1901. One cotype.

Taracticus similis *Will.*, Biol. Centr.-Am., Dipt. I, 312, 1901. Eight cotypes.

Taracticus nigripes *Will.*, Biol. Centr.-Am., Dipt. I, 313, 1901. Six cotypes.

Cophura pulchella *Will.*, Biol. Centr.-Am., Dipt. I, 314, 1901. One cotype.

Atomosia anonyma *Will.*, Biol. Centr.-Am., Dipt. I, 316, 1901. One cotype.

Erax concinnatus *Will.*, Biol. Centr.-Am., Dipt. I, 323, 1901. Two cotypes.

Asilus tenebrosus *Will.*, Biol. Centr.-Am., Dipt. I, 328, 1901. Two cotypes.

Asilus nigrocaudatus *Will.*, Biol. Centr.-Am., Dipt. I, 329, 1901. Four cotypes.

Asilus xanthocerus *Will.*, Biol. Centr.-Am., Dipt. I, 329, 1901. Four cotypes.

Asilus melanocerus *Will.*, Biol. Centr.-Am., Dipt. I, 329, 1901. Two cotypes.

Asilus dolichomerus *Will.*, Biol. Centr.-Am., Dipt. I, 329, 1901. Four cotypes.

Asilus alterus *Will.*, Biol. Centr.-Am., Dipt. I, 330, 1901. Three cotypes.

Asilus anonymus *Will.*, Biol. Centr.-Am., Dipt. I, 330, 1901. Four cotypes.

Asilus capillatus *Will.*, Biol. Centr.-Am., Dipt. I, 330, 1901. Two cotypes.

Family Dolichopodidæ.

Psilopus (Psilopodinus) bellulus *Aldrich*, Trans. Ent. Soc. Lond., 343, 1896. Two cotypes.

Psilopus (Psilopodinus) insularis *Aldrich*, Trans. Ent. Soc. Lond., 344, 1896. Four cotypes.

Gnamptopsilopus (Agonosoma) flavidus *Aldrich*, Trans. Ent. Soc. Lond., 341, 1896. Two cotypes. The generic name *Psilopus* is written on the type label.

Gnamptopsilopus (Agonosoma) flavicornis *Aldrich*, Trans. Ent. Soc. Lond., 342, 1896. One cotype.

Diaphorus palpiger *Wheeler*, Psyche, V, 360, 1890. One type. In a former list of types of Diptera three types are said to be in the Museum. This is an error.

Diaphorus parvulus *Aldrich*, Trans. Ent. Soc. Lond., 321, 1896. One cotype.

Diaphorus contiguus *Aldrich*, Trans. Ent. Soc. Lond., 323, 1896. Four cotypes.

Diaphorus flavipes *Aldrich*, Trans. Ent. Soc. Lond., 323, 1896. Four cotypes.

Diaphorus dubius *Aldrich*, Trans. Ent. Soc. Lond., 324, 1896. Four cotypes.

Asyndetus syntormoides *Wheeler*, Proc. Cal. Acad. Sci., 3d ser., II, 32, 1899 Three types.

Porphyrops effilatus *Wheeler*, Proc. Cal. Acad. Sci., 3d ser., II, 34, 1899. Seven types.

Anepsius (Anepsiomyia) linearis *Aldrich*, Trans. Ent. Soc. Lond., 317, 1896. Four cotypes.

Hydrophorus philombrius *Wheeler*, Proc. Cal. Acad. Sci., 3d ser., II, 65, 1899. One type, not four as is mentioned in a previous publication.

Dolichopus amnicola *Melander and Brues*, Biol. Bull., I, 130, 1900. One type.

Dolichopus paluster *Melander and Brues*, Biol. Bull., I, 136, 1900. Ten types.

Dolichopus pantomimus *Melander and Brues*, Biol. Bull., I, 142, 1900. One type.

Dolichopus renidescens *Melander and Brues*, Biol. Bull., I, 143, 1900. Three types.

Dolichopus opheles *Melander and Brues*, Biol. Bull., I, 144, 1900. One type.

Dolichopus amphericus *Melander and Brues*, Biol. Bull., I, 146, 1900. Five types.

Dolichopus partitus *Melander and Brues*, Biol. Bull., I, 135, 1900. Two types.

Dolichopus henshawi *Wheeler*, Psyche, V, 340, 1900. Three types.

Hygroceleuthus (Dolichopus) crenatus *Osten-Sacken*, Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), III, 312, 1877. One type.

Family Empididæ.

Drapetis flavidus *Will.*, Trans. Ent. Soc. Lond., 308, 1896. Five types.

Drapetis apicis *Will.*, Trans. Ent. Soc., Lond., 442, 1896. Two types.

Phoneutisca simplicior *Wheeler and Melander*, Biol. Centr.-Am., Dipt. I, 375, 1901. One type.

Hemerodromia defessa *Will.*, Trans. Ent. Soc. Lond., 439, 1896. One type.

Clinocera lecta *Melander*, Trans. Am. Ent. Soc., XXVIII, 243, 1902. Two types.

Leptopeza disparilis *Melander*, Trans. Am. Ent. Soc., XXVIII, 258, 1902. Three types.

Empis enodis *Melander*, Trans. Am. Ent. Soc., XXVIII, 303, 1902. Four types.

Parathalassius aldrichi *Melander*, Ent. News, XVII, 374, 1906. Three types.

Thinodromia inchoata *Melander*, Ent. News, XVII, 370, 1906. One type.

Family SYRPHIDÆ.

Microdon mirabilis *Will.*, Trans. Am. Ent. Soc., XV, 257, 1888. Two types labelled respectively Chapada and Rio de Janiero, Brazil. Williston gives Chapada only as the locality from whence the types came. The specimens, however, which differ considerably from each other are both covered by the original description.

Microdon inermis *Will.*, Trans. Am. Ent. Soc., XV, 258, 1888. One type.

Chilosiac hrysochlamys *Will.*, Biol. Centr.-Am., Dipt. III, 8, 1891. Two cotypes.

Baccha stenogaster *Will.*, Trans. Am. Ent. Soc., XV, 266, 1888. One type.

Baccha exigua *Will.*, Trans. Am. Ent. Soc., XV, 267, 1888. Two types.

Baccha placiva *Will.*, Trans. Am. Ent. Soc., XV, 269, 1888. Two types.

Baccha rubida *Will.*, Biol. Centr.-Am., Dipt. III, 34, 1891 One cotype.

Baccha punctifrons *Will.*, Biol. Centr.-Am., Dipt. III, 36, 1891. One cotype

Baccha dolosa *Will.*, Biol. Centr.-Am., Dipt. III, 37, 1891. One cotype.

Baccha lugubris *Will.*, Biol. Centr.-Am., Dipt. III, 37, 1891. Four cotypes.

Melanostoma longicornis *Will.*, Trans. Am. Ent. Soc., XV, 263, 1888. Four types.

Melanostoma scitulum *Will.*, Trans. Am. Ent. Soc., XV, 264, 1888. One type.

Melanostoma catabombum *Will.*, Biol. Centr.-Am., Dipt. III, 12, 1891. Four cotypes.

Didea coquilletti *Will.*, Biol. Centr.-Am., Dipt. III, 19, 1891. One cotype.

Syrphus erraticus *Will.*, Trans. Am. Ent. Soc., XV, 264, 1888. Six types.

Syrphus bisinuatus *Will.*, Biol. Centr.-Am., Dipt. III, 17, 1891. One cotype.

Syrphus decipiens *Will.*, Biol. Centr.-Am., Dipt. III, 18, 1891. Four cotypes.

Volucella æmula *Will.*, Trans. Am. Ent. Soc., XV, 272, 1888. Two types.

Volucella meretricias *Will.*, Trans. Am. Ent. Soc., XV, 272, 1888. Six types.

Volucella prescutellaris *Will.*, Trans. Am. Ent. Soc., XV, 273, 1888. Eight types.

Volucella persimilis *Will.*, Trans. Am. Ent. Soc., XV, 273, 1888. Eleven types. The species was described from eleven specimens taken in three different localities. Only two of the localities are represented by our specimens, but Dr. Williston says nevertheless that all our specimens are types.

Volucella musta *Will.*, Trans. Am. Ent. Soc., XV, 274, 1888. Eight types.

Volucella mus *Will.*, Trans. Am. Ent. Soc., XV, 274, 1888. Eleven types, all except one from Chapada, the type locality for the species. The odd one from Piedra, Brazil, Dr. Williston says is also a type.

Volucella viridis *Will.*, Trans. Am. Ent. Soc., XV, 275, 1888. Five types.

Volucella ornata *Will.*, Biol. Centr.-Am., Dipt. III, 49, 1891. One cotype.

Eristalis ochraceus *Will.*, Trans. Am. Ent. Soc., XV, 279, 1888. One type.

Eristalis volaticus *Will.*, Trans. Am. Ent. Soc., XV, 280, 1888. Five types.

Eristalis precipuus *Will.*, Trans. Am. Ent. Soc., XV, 280, 1888. Nine types.
Eristalis parvulus *Will.*, Trans. Am. Ent. Soc., XV, 282, 1888. One type.
Eristalis montanus *Will.*, Proc. Am. Phil. Soc., XX, 322, 1882. One type.
Pteroptila æmula *Will.*, Trans. Am. Ent. Soc., XV, 283, 1888. Two types.
Mallota margarita *Will.*, Biol. Centr.-Am., Dipt. III, 70, 1892. Three cotypes
Mallota smithi *Will.*, Biol. Centr.-Am., Dipt. III, 70, 1892. Four cotypes.
Xylota genuina *Will.*, Trans. Am. Ent. Soc., XV, 284, 1888. One type.
Xylota rufipes *Will.*, Biol. Centr.-Am., Dipt. III, 71, 1892. One cotype.
Ceriogaster foscithorax *Will.*, Trans. Am. Ent. Soc., XV, 286, 1888. Two types.
Sphecomyia occidentalis *Osburn*, Can. Ent., XL, 12, 1908. One cotype.
Ceria wulpii *Will.*, Trans. Am. Ent. Soc., XV, 290, 1888. Five cotypes.
Ceria braueri *Will.*, Trans. Am. Ent. Soc., XV, 289, 1888. One cotype.
Ceria mikii *Will.*, Trans. Am. Ent. Soc., XV, 288, 1888. Four cotypes.
Ceria bigotii *Will.*, Trans. Am. Ent. Soc., XV, 291, 1888. Two cotypes.
Ceria lynchii *Will.*, Trans. Am. Ent. Soc., XV, 287, 1888. One cotype.
Ceria roederii *Will.*, Trans. Am. Ent. Soc., XV, 289, 1888. One cotype.

Habromyia cœruleithorax *Will.*, Trans. Am. Ent. Soc., XV, 284, 1888. Two types, male and female. The female is from a locality not mentioned in the original description and this specimen also exceeds by several millimeters the greatest measurement given. Dr. Williston says in regard to these types, however: "I am confident that both specimens are types. The probable explanation is that I described originally the species from the male, and intercalated the female description without making all the additions in the note."

Apophysophora scutellata *Will.*, Trans. Am. Ent. Soc., XV, 277, 1888. Eleven types.

Trichopsomyia puella *Will.*, Trans. Am. Ent. Soc., XV, 260, 1888. Three types.

Trichopsomyia tuberculata *Will.*, Trans. Am. Ent. Soc., XV, 260, 1888. One type.

Trichopsomyia polita *Will.*, Trans. Am. Ent. Soc., XV, 260, 1888. Two types.

Trichopsomyia longicornis *Will.*, Trans. Am. Ent. Soc., XV, 261, 1888. One type.

Lepidostola pulchra *Will.*, Trans. Am. Ent. Soc., XV, 261, 1888. Four types.

Lepidostola abdominalis *Will.*, Trans. Am. Ent. Soc., XV, 262, 1888. One type.

Lepidostola similis *Will.*, Trans. Am. Ent. Soc., XV, 262, 1888. One type.

Family CONOPIDÆ.

Tropidomyia bimaculata *Will.*, Can. Ent., XX, 11, 1888. Three cotypes.
Conops argentifaceis *Will.*, Kans. Univ. Quart., I, 43, 1892. One cotype.
Conops parvus *Will.*, Kans. Univ. Quart., I, 46, 1892. Two cotypes.
Conops rufus *Will.*, Kans. Univ. Quart., I, 44, 1892. Two cotypes.
Conops xanthopareus *Will.*, Trans. Conn. Acad., IV, 332, 1885. One type.
Conops magnus *Will.*, Kans. Univ. Quart., I, 43, 1892. Four cotypes.
Conops inornatus *Will.*, Kans. Univ. Quart., I, 45, 1892. Two cotypes.
Conops grandis *Will.*, Kans. Univ. Quart., I, 44, 1892. Three cotypes.
Conops fronto *Will.*, Trans. Conn. Acad. Sci., VI, 378, 1885. One type.

Conops discalis *Will.*, Biol. Centr.-Am., Dipt. III, 80, 1892. One cotype.

Conops anthreas *Will.*, Biol. Centr.-Am., Dipt. III, 80, 1892. One cotype.

Conops angustifrons *Will.*, Kans. Univ. Quart., I, 44, 1892. One cotype.

Physocephala sororcula *Will.*, Biol. Centr.-Am., Dipt. III, 83, 1892. One cotype.

Physocephala xanthops *Will.*, Biol. Centr.-Am., Dipt. III, 83, 1892. One cotype.

Family TACHINIDÆ.

Cistogaster insularis *Will.*, Trans. Ent. Soc. Lond., 351, 1896. One cotype.

Atrophopoda (Paradidyma) townsendi *Will.*, Trans. Ent. Soc. Lond., 356, 1896. Two cotypes.

Atrophopoda (Paradidyma) braueri *Will.*, Trans. Ent. Soc. Lond., 357, 1896. Two cotypes.

Family DEXIDÆ.

Phynchodexia sororia *Will.*, Trans. Ent. Soc. Lond., 360, 1896. Three types.

Family SARCOPHAGIDÆ.

Sarcophaga micropygialis *Will.*, Trans. Ent. Soc. Lond., 363, 1896. Two cotypes.

Sarcophaga otiosa *Will.*, Trans. Ent. Soc. Lond., 364, 1896. Two cotypes.

Sarcophaga chætopygialis *Will.*, Trans. Ent. Soc. Lond., 366, 1896. Four cotypes.

Family MUSCIDÆ.

Chrysomyia desvoidyi *Hough*, Kans. Univ. Quart., IX, 208, 1900. One type.

Morellia nigricosta *Hough*, Kans. Univ. Quart., IX, 216, 1900. Two types.

Mucina brunnea *Hough*, Kans. Univ. Quart., IX, 220, 1900. One type.

Mucina varicolor *Hough*, Kans. Univ. Quart., IX, 226, 1900. Two types.

Mucina latipennis *Hough*, Kans. Univ. Quart., IX, 229, 1900. One type.

Family HETERONEURIDÆ.

Heteroneura flavipes *Will.*, Trans. Ent. Soc. Lond., 387, 1896. One type.

Heteroneura lumbalis *Will.*, Trans. Ent. Soc. Lond., 388, 1896. Two types.

Heteroneura valida *Will.*, Trans. Ent. Soc. Lond., 388, 1896. Two types.

Family BORBORIDÆ.

Limosina dolorosa *Will.*, Trans. Ent. Soc. Lond., 432, 1896. One type.

Family SAPROMYZIDÆ.

Sapromyza angustipennis *Will.*, Trans. Ent. Soc. Lond., 381, 1896. Two cotypes.

Sapromyza puella *Will.*, Trans. Ent. Soc. Lond., 381, 1896. Four coty

Sapromyza octovittata *Will.*, Trans. Ent. Soc. Lond., 382, 1896. cotypes.

Sapromyza exul *Will.*, Trans. Ent. Soc. Lond., 382, 1896. Three cotypes.
Sapromyza sordida *Will.*, Trans. Ent. Soc. Lond., 483, 1896. One type.
Sapromyza venusta *Will.*, Trans. Ent. Soc. Lond., 384, 1896. Two cotypes.
Sapromyza sororia *Will.*, Trans. Ent. Soc. Lond., 385, 1896. Four cotypes.
Sapromyza ingrata *Will.*, Trans. Ent. Soc. Lond., 385, 1896. Four cotypes.
Sapromyza picrula *Will.*, Kans. Univ. Quart., VI, 10, 1897. Six cotypes.

Family Rhopalomeridæ.

Rhopalomera ciliata *Will.*, Psyche, VII, 186, 1895. One type.
Rhopalomera xanthops *Will.*, Psyche, VII, 213, 1895. One type.
Apophorhynchus flavidus *Will.*, Psyche, VII, 186, 1895. Two types.

Family Trypetidæ.

Spilographa setosa *Doane*, Jour. N. Y. Ent. Soc., VII, 178, 1899. One cotype.
Trypeta straminea *Doane*, Jour. N. Y. Ent. Soc., VII, 179, 1899. One cotype.
Rhagoletis ribicola *Doane*, Ent. News, IX, 69, 1898. Two cotypes.
Tephritis variabilis *Doane*, Jour. N. Y. Ent. Soc., VII, 188, 1899. One cotype.

Family Micropezidæ.

Calobata mellea *Will.*, Trans. Ent. Soc. Lond., 373, 1896. Two types.

Family Sepsidæ.

Sepsis insularis *Will.*, Trans. Ent. Soc. Lond., 431, 1896. One type.

Family Ephydridæ.

Notiphila bellula *Will.*, Trans. Ent. Soc. Lond., 390, 1896. Two types.

Notiphila pulchifrons *Will.*, Kans. Univ. Quart., VI, 5, 1897. Two types.

Notiphila stricta *Will.*, Kans. Univ. Quart., VI, 5, 1897. One type.

Paralimna multipunctata *Will.*, Trans. Ent. Soc. Lond., 390, 1896. Two types.

Paralimna obscura *Will.*, Trans. Ent. Soc. Lond., 391, 1896. Five types.

Gastrops niger *Will.*, Kans. Univ. Quart., VI, 3, 1896. Thirteen types. The generic name *Ventrops* is written on the type label.

Hecamede (Allotrichoma) abdominalis *Will.*, Trans. Ent. Soc. Lond., 398, 1896. Three types.

Discomyza dubia *Will.*, Trans. Ent. Soc. Lond., 392, 1896. Two types.

Discomyza nana *Will.*, Trans. Ent. Soc. Lond., 396, 1896. Two types.

Ilythea flavipes *Will.*, Trans. Ent. Soc. Lond., 403, 1896. One type, in poor condition.

Discocerina obscura *Will.*, Trans. Ent. Soc. Lond., 397, 1896. Two types.

Ochthera humilis *Will.*, Kans. Univ. Quart., VI, 6, 1897. One type.

Ochtheroidea atra *Will.*, Trans. Ent. Soc. Lond., 401, 1896. Three types.

Pelomyia occidentalis *Will.*, Proc. Wash. Acad. Sci., II, 461, 1893. One type.

Ephydra pygmæa *Will.*, Trans. Ent. Soc. Lond., 402, 1896. Two types.

Family OSCINIDÆ.

Hippelates proboscidens *Will.*, Trans. Ent. Soc. Lond., 418, 1896. Three types.

Elachiptera flavida *Will.*, Trans. Ent. Soc. Lond., 417, 1896. Three types.

Oscinis incipiens *Will.*, Trans. Ent. Soc. Lond., 424, 1896. Four types.

Oscinis fur *Will.*, Trans. Ent. Soc. Lond., 425, 1896. Two types.

Family DROSOPHILIDÆ.

Drosophila ornatipennis *Will.*, Trans. Ent. Soc. Lond., 407, 1896. Two types.

Drosophila vitattifrons *Will.*, Trans. Ent. Soc. Lond., 408, 1896. One type.

Drosophila coffeata *Will.*, Trans. Ent. Soc. Lond., 409, 1896. Two types.

Drosophila annulata *Will.*, Trans. Ent. Soc. Lond., 409, 1896. One type.

Drosophila fasciola *Will.*, Trans. Ent. Soc. Lond., 410, 1896. One type.

Drosophila bellula *Will.*, Trans. Ent. Soc. Lond., 410, 1896. One type.

Drosophila opaca *Will.*, Trans. Ent. Soc. Lond., 411, 1896. One type.

Drosophila pallida *Will.*, Trans. Ent. Soc. Lond., 415, 1896. Two types.

Drosophila similis *Will.*, Trans. Ent. Soc. Lond., 415, 1896. Two types.

Family AGROMYZIDÆ.

Agromyza lateralis *Will.*, Trans. Ent. Soc. Lond., 428, 1896. One type.

Agromyza sorosis *Will.*, Trans. Ent. Soc. Lond., 429, 1896. Three types.

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Article XXXI.—A REVIEW OF THE SPECIES COMPRISING THE *GLAUCINA-CŒNOCHARIS* GROUP.

By John A. Grossbeck.

The species which I have here collectively called, for convenience, the *Glaucina-Cœnocharis* group do not comprise a compact and homogeneous assemblage. The name might appropriately be applied only to the first three genera considered, which, however, contain most of the species. The others are more or less distantly related but are more nearly so to *Glaucina* and *Cœnocharis* than to any other genera. However, as a whole, where the species do not agree in the curious frontal protuberance, they do agree in the elongated wings. All the species with the exception of *Exelis pyrolaria* and two species of the genus *Tornos*, namely *scolopacinaria* and *cinctarius*, which occur chiefly in the southeast, are confined to the more arid regions of the Southwest — Colorado, Utah, Nevada, New Mexico, Arizona, southern California and the western extension of Texas.

It was the intention of the author in commencing the revision of this group of genera to carefully monograph the entire series, and for this reason material was sought from all available sources. The net result was the accumulation of over five hundred specimens of these insects which as a rule are rare in collections. Unfortunately the condition of the specimens was on the whole unsatisfactory; and the further fact that many new species represented by only a few, frequently poor, specimens, were among the material rendered the task impracticable.

For the loan of specimens I have to thank Dr. Wm. Barnes of Decatur, Illinois, Mr. R. F. Pearsall, of Brooklyn, N. Y., Mr. Geo. H. Field, of San Diego, California and Mr. Jacob Doll of the Brooklyn Institute Museum. To Dr. H. G. Dyar of the United States National Museum, likewise, my thanks are due for having kindly compared specimens for me with types in the National Museum.

Table for the separation of the genera considered in this paper.

Posterior tibia with only one pair of spurs
  Front strongly tubercled, costa of primaries arched, the anal angle rounded **_Synglochis._**
  Front smooth, costa of primaries straight or slightly concave, anal angle pronounced . . . . **_Holochroa._**

Posterior tibia with two pairs of spurs
  Front tubercled or strongly produced
    Costa of primaries straight or almost so, anal angle pronounced
      Wings rather short and broad, palpi short . . . *Morina.*
      Wings long, palpi long and slender . . . . *Stenocharis.*
    Costa of primaries arched, anal angle not pronounced
      Anterior tibia armed with a claw . . . . *Glaucina.*
      Anterior tibia unarmed . . . . . . *Cænocharis.*
  Front smooth, not produced
    Discal spot composed of long, erect scales, male antennæ bipectinate,
      female antennæ simple . . . . *Tornos.*
    Discal spot not noticeably raised above level of rest of wing, male and
      female antennæ bipectinate . . . . *Ezelis.*

Glaucina and *Cænocharis* are structurally alike except for the claw on the anterior tibia of the former. The type of *Glaucina* is *escaria* Grt. and of *Cænocharis*, *interruptaria* Grt. I have examined the type male and female of the first named species and the type female of the last named and find the following additional differences which however do not hold when other specimens of the same genera and even of the same species are examined: the truncated cone of the front in *Glaucina* is slightly more developed than in *Cænocharis*, and the tongue seems stronger, in *Glaucina* there is no accessory cell and R_2, R_{3+4} and R_5 are on one stem, whereas in *Cænocharis* an accessory cell is present and all four branches of the radius are on one stalk. In venation, however, I am inclined to believe that the female type of *interruptaria* is an anomaly for in no other specimen referable to either of the two genera have I been able to discover an accessory cell.

Synglochis is nearly allied to the above two genera, differing chiefly in the absence of the upper pair of spurs on the hind tibia, the much longer truncated cone on the front and in the tongue which is rudimentary; from *Cœnocharis* it differs further in the presence of the tibial claw.

Morina is widely different from any of the foregoing in wing shape, which is broader, and, in the primaries, more pointed at the apex, with a straighter, almost concave costa, and with the anal angle produced. The antennal pectinations in the male, also, are much shorter, being bipectinate but not plumose, and clavate apically. From *Synglochis* it may be distinguished further by the presence of a second pair of spurs on the posterior tibia, which, however, are only half as long as the apical pair, and from *Cœnocharis* by the presence of the tibial spur. There is a distinct accessory cell and the subcosta of the secondaries instead of approximating the radius in the region of the discal cell for two-thirds the length of the cell, touches or almost touches this vein only on the second fourth.

Stenocharis is a long-winged genus with the costa of the primaries straight or slightly concave and the anal angle developed. It is unique in the series by having both thoracic and abdominal tuftings, and long slender palpi, and, with *Holochroa,* in having twelve instead of eleven veins, R_3 and R_4 being separate. In the character of the front it stands between the foregoing genera and *Tornos,* being neither smooth nor markedly tubercled, but rather between. It is bulged outwardly and has a circular disk, but neither the rim nor the center appear to be raised, though there is a misleading clump of dark colored scales in the center of the disk of the single species that has so far been assigned to the genus which might easily be construed as an eminence. The antennal pectinations of the male are quite long and clavate and again resemble those of *Tornos.* The fore tibia is unarmed; there is no accessory cell but a tendency for one to form between R_4 and R_5, and the subcosta of the secondaries approximates the radius on the second third of the discal cell.

Tornos and *Exelis,* though so different in the character of the female antennæ, are much alike in other respects. Both have absolutely smooth fronts, and are so distinguishable from all the preceding. Both have heavy, short, porrect palpi, strongly developed tongues and a similar venation. The accessory cell was present in every specimen of *Tornos* examined, but in *Exelis* this proved variable and in the two specimens in which this character could be clearly seen one had the cell and the other lacked it. Packard's drawing of the venation of *Tornos* (Monogr. Geom., pl. II, f. 4), however, I may add, does not show an accessory cell.

Holochroa may be distinguished from all the genera treated here, except *Synglochis,* by possessing only a single pair of spurs on the posterior tibia. From this one genus it differs in many particulars: in the small slender, palpi, long-haired beneath, which are closely applied to the head and therefore slightly upturned, in the smooth front and heavily bipectinate instead of plumose antennæ, and also in wing shape which in the primaries though long is very straight on the costa and somewhat produced at the anal angle. It agrees again with *Synglochis* in having a rudimentary tongue. There are twelve veins in the forewings, agreeing in this respect with *Stenocharis.* The radial veins of the primaries with the subcosta are curved toward the costa and in the specimens examined the subcosta formed a second accessory cell by its union with R_1 in the region of the normal accessory cell.

The genera *Glaucina* and *Cœnocharis* have been a source of much perplexity to me. True, from a comparative study of their respective type species slight differences in the strength of the tongue as well as in the development of the protuberance on the front were found in addition to the chief differentiating character, the tibial claw, but these minor differences practically disappear when all the species of each genus are studied, and are therefore of no generic value. From an examination of many specimens of *Glaucina epiphysaria* I was at one time led to believe that even the tibial claw was variable, but this proved later to be an error. It appears to be constant and as a convenience in dividing an unwieldy group I have kept the genera distinct on this character despite the fact that the type of *Cœnocharis interruptaria*, certainly having no claw, is in general appearance almost precisely like some specimens of *Glaucina mormonaria*, a species with a well developed claw.

Glaucina *Hulst.*

1896. Hulst, Trans. Am. Ent. Soc., XXIII, 352. Type, *escaria* Grote.

Nine species referable to this genus have already been described: *eupetheciaria*, *pygmeolaria*, *escaria*, *elongata*, *golgolata*, *puellaria*, *erroraria*, *mormonaria* and *epiphysaria*. The last named is a very distinct species allied to *golgolata*. *Mormonaria*, likewise, is an easily recognizable species which in general appearance finds its nearest ally in *Cœnocharis* (*interruptaria*). The remaining species are closely related, differing chiefly only in size. In color all the sizes vary from pale gray to dark brownish-gray and as the style of maculation is practically identical in all it is impossible to draw distinct lines between the different ones. Yet that several species are concerned is evidenced by the structure of the genitalia.

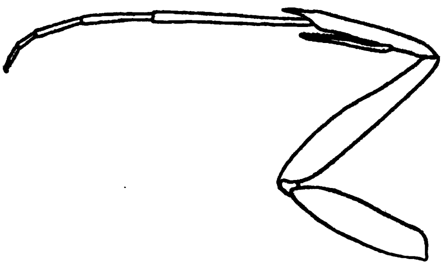

Fig. 1. Fore leg of *Glaucina*.

Glaucina escaria *Grote.*

1882. Grote, Can. Ent., XIV, 186, *Tornos*.
1883. Grote, Can. Ent., XV, 24, *Tornos*.
1887. Hulst, Ent. Am., III, 11, *Lepiodes*.
1896. Hulst, Trans. Am. Ent. Soc., XXIII, 352, *Glaucina*.

All manner of species have been passing current as *escaria* and not one as far as I have seen them are identical with Grote's types. It is possible that one or two of the specimens I have identified as *escaria* may not be that species, the Phœnix, Arizona, specimen for instance being whiter than the types and almost without markings, while the Redington example is gray instead of brownish in tint and is apparently smoother in the texture of the wings; but these differences, I believe, are within the range of variation of the species.

Habitat: All the specimens I have seen are from Arizona,— Yuma Co., March 23; "South Arizona"; Redington; Rio Verde Mts. (Phœnix), Aug.

Types: One male and one female in the Brooklyn Institute Museum; one female in Rutgers College collection.

Glaucina erroraria *Dyar.*

1907. Dyar, Jour. N. Y. Ent. Soc., XV, 106, *Glaucina.*

This species is closely allied to *escaria* and, indeed, may yet be found to be identical with it. The chief points of difference seem to lie in the whiter color of *erroraria* and the absence of the broad marginal band on the hind wings beneath. I have not seen the types, but Dr. Dyar has compared specimens which I had identified as his species with the types and pronounces them identical.

Habitat: Arizona, Hot Springs, June 21, and Tucson, July 19–20; California, Walter's Station, April.

Types: Four females in the National Museum one of which formed part of the material from which Hulst earlier described "*Cœnocharis*" *elongata.*

Glaucina eupetheciaria *Grote.*

1883. Grote, Can. Ent., XV, 24, *Tornos.*
1887. Hulst, Ent. Am. III, 11, *Lepiodes.*
1896. Hulst, Trans. Am. Ent. Soc., XXIII, 353, *Cœnocharis.*
pygmeolaria Grote.
1883. Grote, Can. Ent., XV, 24, *Tornos.*
1887. Hulst, Ent. Am. III, 11. = *Lepiodes escaria.*
1896. Hulst, Trans. Am. Ent. Soc., XXIII, 352, *Glaucina; bon. sp.*

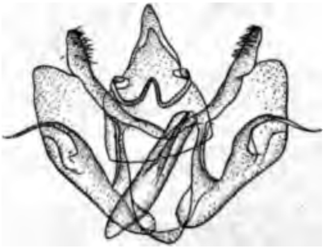

Fig. 2. Genitalia of *Glaucina eupetheciaria.*

All my efforts to make two species out of the types of these names have been futile and I am firmly of the belief that but one species is concerned. In size they are practically alike; all the markings on one can be traced on the other; and they are from the same locality. The only difference is in the color, *eupetheciaria* being a little paler than *pygmeolaria,* and this character is variable in all the members of the genus. In his latest list Hulst places these species in different genera, but an examination of the types shows them to be congeneric. It will be best to regard the two species as one, and as *pygmeolaria* is described second on the same page with *eupetheciaria* it falls to this latter name.

In maculation *eupetheciaria* is practically identical with *puellaria* Dyar, a much larger species, and, as intermediates occur, it is almost impossible to draw a line between them. The genitalia likewise are much alike in both species as the figures show, but that only one species should be involved would seem incredible when we compare the sizes of the extremes, the largest *puellaria* having double the expanse of the smallest *eupetheciaria*.

Habitat: Arizona — Oracle; Phœnix, April 30, May 16, July 11; Baboquivaria Mts., July 15–30; South Arizona, Aug. 15–30; Santa Catalina Mts., July 24–31, Aug. 1–7; Redington; Prescott, May 29, July 23. New Mexico — Deming, July 8–23.

Types: The type of *eupetheciaria*, a unique male, and the male and female type of *pygmeolaria* are in the Brooklyn Institute Museum. Another "type" of *pygmeolaria* is in the Hulst collection at New Brunswick bearing a locality label "Phœnix, Ariz., June 5, '97." Obviously this is no type.

Glaucina puellaria *Dyar.*

1907. Dyar, Jour. N. Y. Ent. Soc., XV, 105, *Glaucina*.

My determination of this species has been verified by Dr. Dyar after a comparison of our specimens with the type. The typical form, a large robust species with heavy markings, is apparently not common: but I have associated with it specimens of a smaller form which merges into *puellaria* on one hand and into *eupetheciaria* on the other: this form is evidently the one mentioned by Dyar in his original description of *puellaria* as a smoother, more silvery-gray species with the markings less defined and more broken. It may represent a new species, but in spite of my long series I am unable to satisfactorily decide this point and for the present leave it undescribed.

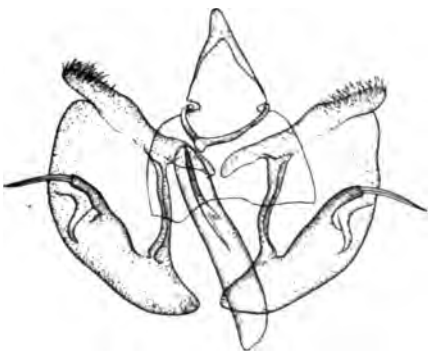

Fig. 3. Genitalia of *Glaucina puellaria*.

Habitat: *Typical form.* Arizona — Baboquivaria Mts., Pima Co.; Phœnix; Catalina Springs; South Arizona. Colorado — Glenwood Springs. *Smaller form.* Arizona — Paradise, Rio Verde Mts. (Phœnix) Aug., Sept.; Yavapai Co.; Yuma Co., April 12–March 28; Baboquivaria Mts., July 8–30; Redington; South Arizona, May 1–15, Sept.; Colorado desert. New Mexico — Deming. California — Walter's Station.

Types: Five females in the U. S. National Museum; one female in collection. F. H. Snow (Kansas).

Glaucina elongata *Hulst.*

1896. Hulst, Trans. Am. Ent. Soc., XXIII, 353, *Cœnocharis.*
1907. Dyar, Jour. N. Y. Ent. Soc., XV, 106, concerning type.

In describing this species Hulst does not say how many specimens were in hand, but from the fact that two localities are given, Texas and Arizona, we know that more than one specimen was before the author. There are at least five types labelled as such in existence, a male and female in Hulst's own collection, a female in the Brooklyn Institute Museum, and two specimens in the National Museum, one of which as above mentioned, a female from Arizona, formed part of the material from which Dyar described his *Glaucina erroraria.* The other type in the National Museum Dyar says is *Glaucina pygmeolaria.* Dyar rejected the Arizona type because it had a spur on the fore tibia and so went into the genus *Glaucina* whereas Hulst described the species in *Cœnocharis.* As a matter of fact all the types whether from Texas or Arizona have the tibial spur. The Texas types, however, differ from those from Arizona in their clay-yellow rather than gray color which renders the insect very different in general aspect; it is, I presume, a distinct species allied to *puellaria.* Dyar has already limited Hulst's name to this form by using an Arizona specimen as the type of another species.

Habitat: San Antonio, Texas.
Types: The location of these is indicated above.

Glaucina pearsalli, new species.

Expanse, 33–35 mm. Head, body and primaries dark ash-gray; secondaries white, except the inner area which is dark ash gray. Intradiscal line of primaries more than one-third out, blackish, rather broad and diffuse, crenulate; as a whole rather straight except at costa where it bends in toward costal margin. Extradiscal line blackish, more defined, crenulate, extends from less than one-fourth in from apex to middle of inner margin. Occasionally these lines are obsolete or, on the other hand, emphasized on the veins. Discal spot round, black, diffuse. Fringe gray. Secondaries with a blackish median line showing on inner area. Terminal line blackish. Discal spot moderate in size, conspicuous on the clear white ground. Fringe white. Beneath, whitish with a sparse scattering of fine gray scales which gather particularly on the costa and toward the apex of primaries and on inner area of secondaries. Discal spots present on all wings and usually conspicuous.

Types: Four males from Mr. R. F. Pearsall, one cotype of which is in the American Museum of Natural History.

Habitat: Parker, Arizona, March 7, 12, 13 and 14.

Pearsalli resembles *puellaria* in size and markings but the secondaries except for the inner area are glistening white, not smoky, and the primaries are a soft ash-gray rather than brownish-gray. The genitalia show that we have here a valid species and not a mere variety to contend with.

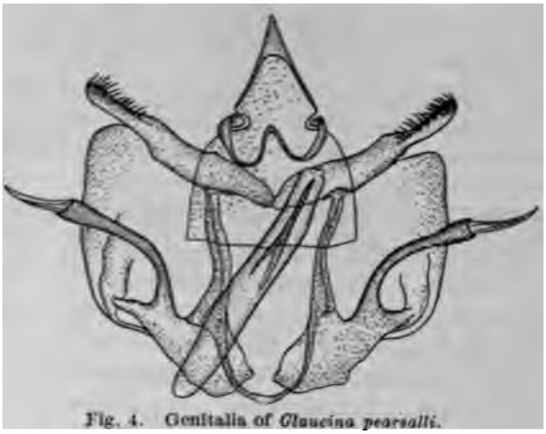

Fig. 4. Genitalia of *Glaucina pearsalli*.

Glaucina abdominalis new species.

Expanse, 23–24 mm. Head, thorax and all wings whitish, rather sparsely sprinkled over with fine blackish scales. Abdomen whitish, becoming brownish apically, and with a moderate sized spot bordered with brown on each of the first two segments. Intradiscal line indicated by an obscure, irregular shade. Extradiscal line brown, narrow, denticulate, extending in a rather straight line from one-fourth in on costa to one-third in on inner margin. Subterminal line absent. Terminal line brown, fine, continuous. Discal spot a small obscure, linear spot. Fringes white. Secondaries with a faint indication of an irregular line running through the center. Discal spot small, round, distinct. Terminal line and fringes as in primaries. Beneath, uniformly whitish, the discal spots and terminal lines faintly indicated.

Described from two male specimens collected by Mr. Geo. H. Field. Type in the American Museum of Natural History; cotype in Mr. Field's collection.

Habitat: San Diego, California, July 31 and August 1.

With its pale color, almost straight denticulate line, and spotted abdomen this species should be rather easily distinguished from all other described species of the genus.

Glaucina bilineata, new species.

Expanse, 35 mm. Head, body and fore-wings an even brown-gray. Primaries crossed by two contrasting, narrow, black lines. The inner or intradiscal begins one-third out on costa and extends to discal cell, then follows the radial vein outwardly to almost the middle of the cell, crosses the cell at this point and runs inward again on the cubital vein to just below the origin of the line, extending thence sinuously to inner margin. The outer or extradiscal line begins less than one-third in on costa and extends sharply denticulate to one-third in on inner margin running subparallel to the outer margin. Subterminal line scarcely visible as a denticulate whitish shade running through the center of the outer area. Terminal line black, continuous. Discal spot moderate in size, oval, not defined. Fringes concolorous with ground color of wing. Secondaries smoky, paler on disk, of the same color as primaries on inner area. A clearly marked, black denticulate line, extends from the middle of the inner margin to a short distance from Cu_2 ending abruptly at this point. Terminal line black, continuous. Discal spot as in primaries. Fringes smoky becoming whitish toward apical angle. Beneath, pale gray, smoky outwardly on all wings. Discal spots large, conspicuous, especially on secondaries.

Named from one female in Dr. Wm. Barnes's collection.

Habitat: Redington, Arizona.

A very marked species readily known by its two contrasting lines, the inner of which is singular in that it runs outwardly along the veins of the discal cell through the center of which it crosses.

Glaucina epiphysaria *Dyar.*

1908. Dyar, Proc. Ent. Soc. Wash., X, 55, *Glaucina.*

This seems to be a common species in southern California, no less than one hundred and eighty specimens being before me from this region. The dates on the various specimens would seem to indicate that there are two flights annually, one from mid-March or slightly earlier to the end of April, and another from the latter part of June through July, August and September to late October. Probably, however, the species flies continuously from March to October. Dyar suggests (*in litt.*) that this species may equal Strecker's *golgolata* described from Nevada but I am quite convinced that the two forms are distinct.

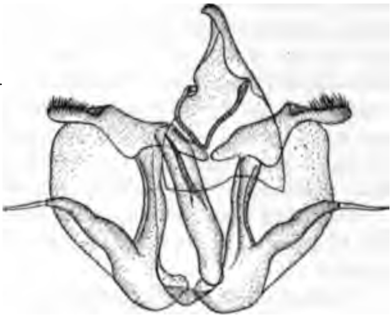

Fig. 5. Genitalia of *Glaucina epiphysaria.*

Habitat: California — San Diego. March 11–Apr. 26, June 21–October 7–29: Pasadena Apr. 29: West Riverside, October 1–28.

Types: One male and two females in the U. S. National Museum.

Glaucina golgolata *Strecker.*

1899. STRECKER. Lep. Rhop. Het., suppl. 2, 11, *Eupethecia.*
1902. HULST. Bull. 52. U. S. Nat. Mus., 272, *Tephroclystia.*
1905. DYAR. Proc. Ent. Soc. Wash., VII, 93, *Glaucina?*

I cannot satisfactorily identify anything before me with this species. Dr. Dyar says (see above) that it may be the same as his *epiphysaria* and certainly it approaches this species more closely than any other; yet in all the series of *epiphysaria* before me not one matches it in all respects. That the two species are distinct I have little doubt.

Habitat: Nevada.

Type: One female in the Field Columbian Museum.

Glaucina magnifica, new species.

Expanse, 28–33. Head, body and fore-wings dark gray, tending to brown. Collar of thorax black. Primaries crossed by two blackish lines sometimes continuous, but usually broken up into spots or dashes; rarely one or both are absent or almost so. Intradiscal line extends obliquely from one-third out on costa to center of discal cell, then, forming an acute angle, extends irregularly inward to near the base of the wing on inner margin. Extradiscal line extends inwardly curved from one-third in on costa to M₃, thence runs irregularly inward to inner margin ending close to the termination of the intradiscal line. A diffuse median shade is sometimes present on the inner margin between the two primary cross-lines and this rarely extends inwardly toward the center of the wing, where it fades out. Subterminal line whitish, distinct, strongly scalloped between the veins. The spaces formed by the subterminal line inwardly are filled in with blackish lunules more or less defined. Terminal line blackish, fine, complete. Discal spot absent or represented by a faint oval shade. Secondaries smoky, gray on inner area where three lines extending a short distance into the wing are more or less sharply marked. Beneath, even smoky-gray on primaries, a discal spot usually showing, whitish and finely irrorate on secondaries, a small round discal spot showing quite conspicuously.

Described from many specimens of both sexes from the collections in the American Museum of Natural History and in those of Mr. R. F. Pearsall and Dr. Wm. Barnes.

Habitat: San Diego, California, August 15 to October 9; and West Riverside, California.

Several specimens too badly rubbed to be made types are dated February 28 and October 1 to Nov. 2.

Though scarcely to be associated with *mormonaria* at first sight the genitalia indicate that these species are closely allied, this structure being practically alike in both. A closer examination shows also that the pattern of the wings is roughly similar though much more definite in *magnifica*. The larger size and far darker coloring of this new species will further distinguish it from the whitish-gray *mormonaria*.

Glaucina hulstinoides, new species.

Expanse, 24.5–27 mm. Head, body and all appendages with mixed white and black scales, sometimes one, sometimes the other color predominating. The posterior part of the head, the collar, and the second abdominal segment are usually almost entirely black. The maculation of the abdomen is various, rarely (in one specimen) assuming double dorsal spots on the posterior segments. The primaries appear oddly longitudinally strigate, and are crossed diagonally (from apex to inner margin) with more or less indefinite cross lines. The longitudinal strigation is brought about by the veins being narrowly lined with clear white. The intradiscal line, narrow and blackish, is only obvious from near the base of the inner margin to the middle of the submedian cell, and even here is often broken or obscured. The extradiscal line is geminate, blackish, and like the intradiscal line begins on the inner margin near the base and extends only partially across the wing; usually continuously to vein cubitus 1 and thence continued in a series of two or three spots above this point. Externally this line is bordered by a white line which extends beyond the black intradiscal line to the costa, curving sharply inward on vein radius$_5$ and then extending in a straight line to the costal margin. A second narrower white line, constituting the subterminal line, runs parallel to this from the inner margin to M$_3$, never exceeding this vein. Terminal line fine, black, continuous. Fringe with a broad blackish band running through the center. The secondaries are quite uniformly grayish or whitish, with the terminal line and fringe as in the primaries and with indications of three blackish straight lines extending from the inner margin partly into the wing. Beneath, the primaries are whitish or grayish with the costa mottled with clear black specks; the secondaries are white with profuse scatterings of black scales, particularly basally; the terminal line and fringe on both wings are as on the upper surface.

Types: Seven males and three females received from Mr. R. F. Pearsall, several cotypes of which are in the American Museum of Natural History.

Habitat: La Puerta, California, October 10 to 22.

This species roughly resembles *Hulstina terlineata* Dyar in superficial aspect, but is a true *Glaucina* having both a tibial spine and tuberculated front.

Glaucina mormonaria *Dyar.*

1907. Dyar, Jour. N. Y. Ent. Soc., XV, 106, *Glaucina*.

This species seems to fly not uncommonly in Utah in association with *Cænocharis interruptaria* Grote from mid-May to mid-September, the specimens found toward the end of the season being smaller than those which emerge earlier. In general the maculation of the wings is more or less broken up and suffused but occasionally becomes definite and then we get a pattern so similar to that of *interruptaria* that for a time I was almost misled into believing that both species were one. The chief superficial difference between the two seems to be in the extradiscal line of the primaries which in *mormonaria* tends to break up into spots while that of *interruptaria* breaks up into dashes on the veins.

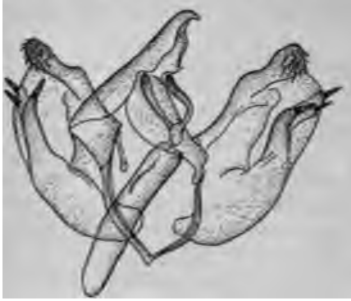

Fig. 6. Genitalia of *Glaucina mormonaria*.

Habitat: Utah — Stockton, May 16, [illegible], June 21, 23, July 30, August 3, 4, Sept. 6–12; Eureka, May 6 to June 9, August 1. Arizona — March 16–23; Redington. Colorado — Durango, July 8–15.

Types: Three males and two females in the U. S. National Museum; one cotype in the American Museum of Natural History.

Cœnocharis *Hulst.*

1896. Hulst, Trans. Am. Ent. Soc., XXIII, 353. Type, *interruptaria* Grote.

Four species belonging to this genus have been described. They are in the order of their description: *interruptaria*, *ochrofuscaria*, *ignavaria* and *denticularia*. *Eupetheciaria* and *elongata* referred to this genus in Hulst's 'Classification' do not, as I have shown in the foregoing, belong here.

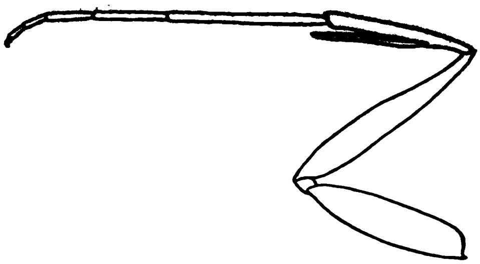

Fig. 7. Fore leg of *Cœnocharis*.

Cœnocharis interruptaria *Grote.*

1882. Grote, Can. Ent., XIV, 185, *Tornos.*
1883. Grote, Can. Ent., XV, 24, *Tornos.*
1887. Hulst, Ent. Am., III, 11, *Lepiodes.*
1888. Hulst, Ent. Am. IV, 49, = *Lepiodes behrensata.*
1896. Hulst, Trans. Am. Ent. Soc., XXIII, 353, *Cœnocharis; bon. sp.*

This species was described from a female taken in Arizona. In general appearance it is extremely close to *Glaucina mormonaria* Dyar and since this name has been proposed *interruptaria* has been masquerading under it.

The species seems to be quite common in Utah where in Stockton we have it as occurring continuously from May 16 to Sept. 12, and in Eureka from May 9 to Aug. 1, skipping however the month of July. It occurs also in Arizona — Prescott, Aug. 30, and Redington — and in Blanco Co., Texas. Dr. Dyar (Proc. Ent. Soc. Wash., V, 226, 1903) records it also from Williams, Ariz.; but it is very doubtful whether this record really refers to *interruptaria.*

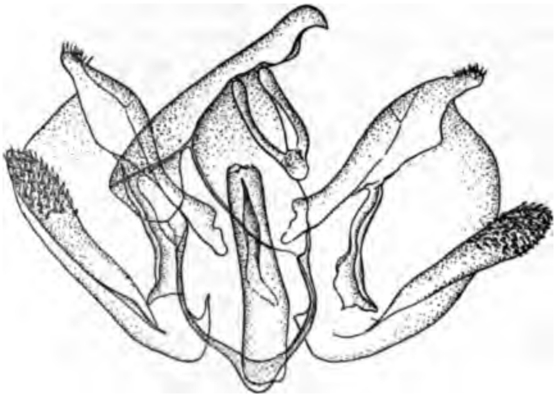

Fig. 8. Genitalia of *Cœnocharis interruptaria.*

Habitat: As above.
Type: One female in the Brooklyn Institute Museum.

Cœnocharis ochrofuscaria *Grote.*

1882. Grote, Can. Ent., XIV, 186, *Tornos.*
1883. Grote, Can. Ent., XV, 25, *Tornos.*
1887. Hulst, Ent. Am., III, 11, var. of *Lepiodes interruptaria.*
1896. Hulst, Trans. Am. Ent. Soc., XXIII, 353, *Cœnocharia; bon. sp.*

This species was described from a single specimen and the fact that the maculation is scant and indistinct may account for its having been unrecognized since it was named. I am pleased to be able to say therefore that several good specimens unquestionably of this species have been discovered.

Habitat: Arizona — Prescott, Sept. 16–18; Phœnix, April 18, 19; Parker, March 9, 12, 15; Christmas, Gila Co.; Redington.
Type: One female in the Brooklyn Institute Museum.

There are evidently several closely allied species comprising the *ochrofuscaria* group. The typical form from Arizona expands 23–27 mm., averaging about 25 mm., and has the markings more or less diffuse; *macdunnoughi* ranges between 26.5 and 29 mm. and has the cross lines emphasized on the veins with the intervening space more or less filled in with dark scales; *indistincta* is the smallest ranging between 20 and 24 mm. with the markings diffused exactly as in *ochrofuscaria;* while *obscura* is much the largest, expanding 30–34 mm. and has the markings even more obscured than either *indistincta* or *ochrofuscaria*. *Macdunnoughi* occurs with the type form in Arizona, and *indistincta* seems to be confined to southern California, from whence many specimens have been received.

Cœnocharis indistincta, new species.

Expanse, 20–24 mm. Head, thorax, abdomen, primaries and inner margin of secondaries whitish, in the male densely, in the female sparsely scattered over with blackish scales. This scattering of scales is very uniform. Primaries with two blackish cross lines, more or less indeterminate, sometimes entirely absent. When present the inner or intradiscal line irregular, begins on inner third or fourth of costa, extends outward in the region of the discal cell, then runs irregularly to inner fourth of posterior margin. The outer or extradiscal line also irregular, begins on outer fourth of costa, extends inwardly curved to center of wing, then forms a V-shaped mark on the crotch of Cu_1 and Cu_2 and runs inward to inner third of posterior margin. Externally this line is bordered by a whitish line of ground color. Subterminal line white, formed by a series of scallops between the veins. Terminal line black, continuous. Discal spot absent. Secondaries except inner margin an even smoky gray (male) or whitish (female). Beneath, primaries pale smoky; secondaries whitish, sparsely irrorate with fine brown atoms. Discal points evident in some specimens.

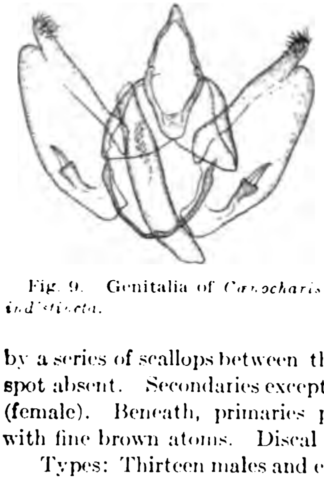

Fig. 9. Genitalia of *Cœnocharis indistincta.*

Types: Thirteen males and eight females collected by Mr. Geo. H. Field. Types and cotypes in the American Museum of Natural History; and cotypes with Mr. Field.

Habitat: San Diego, California, July 11–August 1.

This species is very close to *ochrofuscaria* but is uniformly smaller and lacks that distinct ochreous color which led Grote to apply the name *ochrofuscaria* to his species. It is possible that the two may eventually be found to be the same but since a number of specimens, all similar in size and color, have been identified with Grote's species, I prefer to name the present species rather than unite it doubtfully to another.

Cœnocharis macdunnoughi, new species.

Expanse, 26.5–29 mm. Head, body and ground color of wings whitish or brownish, the latter color produced by a profuse scattering of fine brown scales. Primaries with intradiscal line represented by black dashes on the veins about one-third out on wing. Extradiscal line similarly represented, but occasionally the dashes are feebly connected by a brown diffuse band; together they form a scalloped line, the black dashes constituting the apices of the individual scallops. In its course it extends from one-fourth in on costa irregularly to middle of inner margin, being drawn in between veins Cu_2 and the anal vein and connected at this point with the intradiscal line by an intervenular black dash. A diffuse brownish dash also occupies the discal cell. Outer area pale at extradiscal line, darker outwardly, and with a brown shade running through the center. Terminal line black, continuous. Fringe gray. Secondaries with a moderately broad median line, quite regularly curved, rather feebly defined anteriorly and pronounced at inner margin. Terminal line and fringe as in primaries. Discal spot absent. Beneath pale gray or pale brownish, the secondaries somewhat irrorate with pale brown.

Types: Two females from Dr. Barnes, the cotype of which is in the American Museum of Natural History.

Habitat: Christmas, Gila Co., Ariz., and Redington, Ariz.

This species may be easily recognized by the two cross lines being heavily marked on the veins and between which the space is in part darker than the rest of the wing. I take pleasure in naming this species after Dr. Jas. McDunnough, the indefatigable curator of the Barnes collection of Lepidoptera.

Cœnocharis obscura, new species.

Expanse, 30–34 mm. Head, body and primaries with mixed brown and whitish scales rather evenly distributed. Two blackish lines usually only vaguely indicated cross the primaries. The first, sometimes practically absent, extends out from costa to center of discal cell then bends acutely inward and runs slightly irregularly to inner margin ending one-fifth or less out from base on this margin. The second begins on the costa less than one-fourth in from apex and extends subparallel to outer margin, denticulate to Cu_2, then irregular to near the middle of inner margin. This line is usually emphasized on the veins, and may be entirely lost except on the veins and in the inner area. Subterminal line scarcely traceable in the outer area as a waved whitish line. Terminal line deep brown, continuous. Discal spot not evident. Secondaries rather even pale yellowish-brown except at the inner margin where they are grayish like the fore wings. A single median brown line is indicated at the middle of the inner area. Discal spot absent. Beneath, the primaries are very pale yellowish-brown; the secondaries white with fine brown atoms evenly scattered over the surface. Discal spots absent.

Types: Five males from Dr. Barnes, two cotypes of which are in the American Museum of Natural History.

Habitat: South Arizona, April 1–15 and September.

In style of maculation this species is much like *indistincta* and *ochrofuscaria* but differs greatly in size and is also more uniform in coloring. From *indistincta* it may be further distinguished by the lack of the pure white color on the wings which tends to emphasize the more definite markings in that species.

Cœnocharis ignavaria *Pearsall.*

1906. Pearsall, Sci. Bull. Brook. Inst. Mus., I, 216, *Cœnocharis*.

A large species with the same general type of maculation as *Glaucina eupetheciaria* and *G. puellaria* but larger than either and of a dark grayish-brown or blackish color throughout. The original description reads as though only one specimen served as type but in the list of species taken in Utah, Arizona and Texas preceding the description two males are recorded. June is given as the date of their capture though the cotype in Mr. Pearsall's collection is labelled July. In addition to the type there are two other specimens of the same species in the Brooklyn Museum both according to Mr. Doll collected with the types at Palmerlee, Cochise Co., Ariz. Dr. Barnes has the insect also from the White Mts. and the Huachuca Mts., both in Arizona. Still another specimen which appears to be this species but is somewhat paler in color is from Texas (Brooklyn Museum).

Habitat and types: As above.

Cœnocharis denticularia *Dyar.*

1907. Dyar, Jour. N. Y. Ent. Soc., XV, 107, *Cœnocharis*.

This species still remains known to us by the unique specimen from which it was described. Dyar compares it to *Glaucina golgolata* Streck. but from the description I would say it was nearer my *Glaucina magnifica* in appearance. The species was described from the Chirichua Mts. in Arizona and the type, a male, is in the National Museum.

Cœnocharis eureka, new species.

Expanse, 27–28 mm. Entire moth ashy-gray, caused by the even distribution of fine black scales over a whitish ground. The secondaries, except the inner area, appear smoother and very slightly browner than the primaries. Intradiscal line of primaries represented by an obscure dash at one or two places about one-fourth out from the base of the wing. Extradiscal line brown, begins on costa one-fourth in from the apex and extends irregularly denticulate to the middle of the inner margin, being emphasized on the veins, and lost or faint between them above Cu_1, but continuous below Cu_1. Subterminal line barely traceable as a fine denticulate white line. Terminal line brown, continuous, slightly extended inwardly on the veins. Discal spot absent. Fringes concolorous with ground color. Secondaries with a short distinct line in center of inner area, which may sometimes be traced across the wing as a more or less interrupted denticulate brown line. Discal spot absent. Terminal line brown, even, continuous. Beneath, uniform, ashy-gray.

Types: Two females received from Mr. R. F. Pearsall, one of which, the cotype, is deposited in the American Museum of Natural History.

Habitat: Eureka, Utah, May 9 and 31.

A very distinct and characteristic species distinguished from all others of the genus by the ashen-gray color and the single line obliquely crossing the fore-wings.

Synglochis *Hulst.*

1896. Hulst, Trans. Am. Ent. Soc., XXIII, 351. Type, *perumbraria* Hulst.

Synglochis perumbraria *Hulst.*

1896. Hulst, Trans. Am. Ent. Soc., XXIII, 352, *Synglochis.*

A species with a characteristic robust, rough-scaled appearance by which it can usually be identified. The two broad, diffuse lines crossing the primaries somewhat irregularly will also serve as aids in determination, though one or both of these may be wanting. The peculiar truncated cone on the front is only equalled in size by *Morina coniferaria* Gross., while the single spur on the hind tibia distinguishes it from all other species of the group except *Holochroa dissociarius* Hulst.

Types: The only types that I have been able to locate are one male and one female in the Rutgers College collection at New Brunswick. The female is from San Bernardino, California, and coming from the region from whence the species was described — South California — is undoubtedly a type; but the male (and this sex also was before the author when describing the species as is shown by the generic diagnosis) is from Colorado desert and therefore probably not a type. Though the species was described from specimens received from both Edwards and Riley no types are in either the American Museum or the National Museum collections; nor have I been able to find any in the Brooklyn Institute collection where Hulst placed a part of his types.

Morina, new genus.

Palpi short, not exceeding the front, vestiture loose at base; head when denuded, corneous, vertex high, two small, lobe-like processes beneath each eye, front strongly tuberculed, circular, consisting of a disk with an elevated rim and with a high corneous truncated cone in the center; tongue developed; antennae of male bipectinate, tip simple, the pectinations moderately long and clavate; of female, feebly serrate.

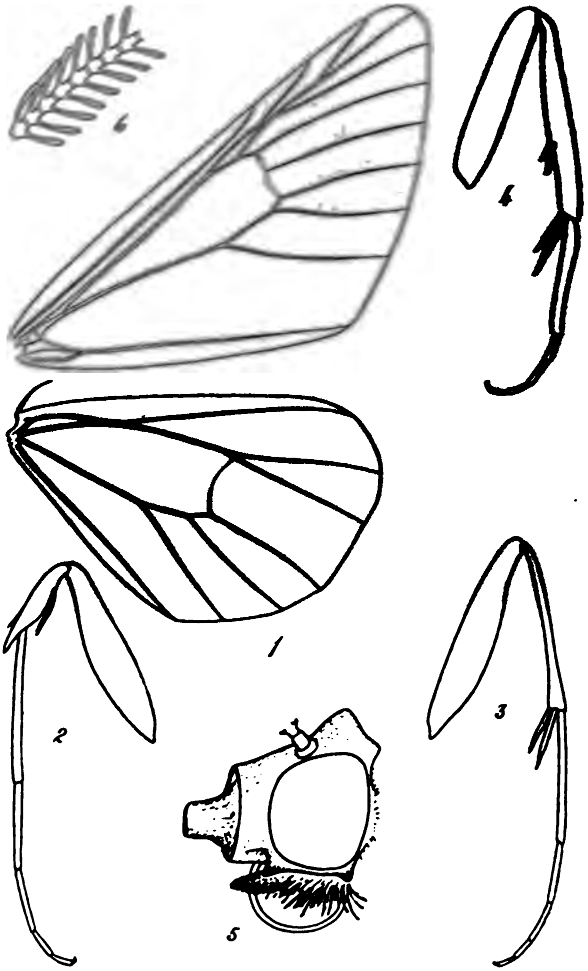

Fig. 10. *Morina*: 1, venation; 2, 3, 4, fore-, mid-, and hind-leg; 5, head in profile; 6, section of male antenna.

Thorax and abdomen untufted. Anterior tibia short, the apex extended into a long heavy spine; posterior tibia not swollen, without hair-pencil, with double pair of spurs. Primaries rather broad, costa straight, apex rounded; secondaries normally broad. Venation: primaries 11 veins, R_2, R_{3+4} and R_5 on one stalk, M_1 from discal cell; one accessory cell present; secondaries, Sc separate, approximating R for a short distance near center of discal cell, M_2 absent.

Type: *Morina coniferaria* Gross.

A gènus distinct from the others of the *Cœnocharis-Glaucina* group by its broader wings. This difference is correlated by differences in head and antennal structure.

Morina coniferaria, new species.

Expanse, 20–24 mm. Head, thorax and abdomen pale brown tending to whitish. Abdomen with double dorsal brown spots on the posterior part of each segment. Primaries reddish-brown over a whitish background. Intradiscal line brown, fine, originates on costa one-third out and extends irregularly outward to near base of wing at inner margin being acutely angled inwardly on anal vein. This line is preceded more or less distinctly by a ferruginous shade. Both lines are occasionally lost in part by the deepening of the ground color. Extràdiscal line brown, fine, originates on costa one-fifth in from apex and extends very irregularly to middle of inner margin. To vein M_1 this line is somewhat broken and runs slightly outwardly toward outer margin; from this point on it is complete. Externally it is bordered by a deep ferruginous shade. Subterminal line whitish, irregular, usually only vaguely showing. Terminal line brown, scalloped. Discal spot small round and usually distinct. A blackish subapical dash in outer area. Secondaries pale, whitish in anterior part, pale brown posteriorly. A distinct median brown line preceded by a brown shade and succeeded by a ferruginous shade is present on the inner margin, and extends only partly into the wing. Subterminal line showing only on posterior half of wing. Terminal line as in primaries. Discal spot small, black, sometimes absent. Beneath, whitish or brownish and more or less speckled with brown. Discal spots usually conspicuous, though sometimes absent.

Types: Two males and two females from Dr. Barnes, a pair of cotypes of which are deposited in the American Museum of Natural History.

Habitat: Baboquivaria Mountains, Pima Co., Ariz., and "South Arizona." May 1–15, July 16–23 and Aug. 1–15.

A very curious species with somewhat the aspect of the members of Boarminæ group. Its structural characters however place it in with *Glaucina* and *Cœnocharis.*

Stenocharis, new genus.

Palpi moderately long, terminal joint long, slender, drooping; tongue strongly developed; front produced, consisting of a circular disk slightly elevated in the center; antennæ of male bipectinate almost to tip, the pectinations rather short and distinctly clavate. Thorax tufted posteriorly. Abdomen long, with dorsal tufts on first four segments, and lateral tufts on the apical segments. Anterior tibia unarmed; posterior tibia slender, without hair-pencil, with two pairs of spurs. Primaries long and narrow, costa rather straight, apex pointed, angle of outer margin at center and anal angle distinct as compared with *Cœnocharis* and *Glaucina*; secondaries moderately broad, slightly excavated between veins M_1 and M_3. Venation: primaries, 12 veins, R_2 and R_3 stalked with R_4; R_5 and M_1 from discal cell, no accessory cell, though there is a tendency for one to form near the base of R_1 and R_2; secondaries, Sc separate, approximating cell to beyond middle, M_2 absent.

Type: *Stenocharis permagnaria* Gross.

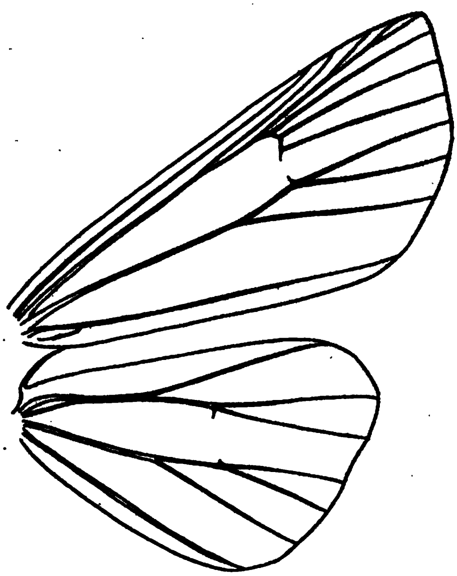

Fig. 11. Venation of *Stenocharis*.

Though belonging to the *Glaucina-Cœnocharis* group this genus differs widely in the shape of the wings, which have a far more squarish rather than elliptical shape, in the short instead of plumose antennal pectinations, in the thoracic and abdominal tufting and in the venation; in addition the style of pattern on the wings is quite different.

Stenocharis permagnaria, new species.

Expanse, 37 mm. Head and body grayish-brown. Thorax with a jet black spot in center near posterior margin, and abdomen with a black tuft on each of the first four segments. Antennæ yellowish-brown, strongly pectinated but not plumose as are those of the other members of the group. Ground color of wings light grayish-brown, the inner area and parts of the costal area of primaries external to the extradiscal line whitish. Intradiscal line blackish, narrow, crosses inner fourth of wing; is rounded outwardly from costa to middle of submedian cell, and, forming a rather sharp angle extends outward again to inner margin. Extradiscal line in width and color similar to intradiscal line; originates on costa beyond the middle and extends in a slightly inward and then broadly outward curve to Cu_2, then turning slightly inward extends wavedly to inner margin. A distinct black apical and three subapical dashes, the central of these latter the largest, are present quite close to the costa. A faint brown and ocherous cloud is also present in the outer area near the anal angle. Terminal line fine, deep brown, continuous. Median and outer areas, especially the median, finely strigate with dark brown. Secondaries pale smoky inwardly, becoming darkly so outwardly. Discal spot faint, lunular. Beneath, pale yellowish-gray becoming on the primaries smoky apically. Cross lines absent, but the apical marks of the upper surface reproduced. Secondaries with terminal line fine, but very contrasting. Discal spot moderate in size, round, brown.

Types: One male from Dr. Barnes and in his collection.
Habitat: Chiricahua Mts., Cochise Co., Arizona, June 16–23.

The unique type is a handsome species with the style of ornamentation approaching that of *Tornos* nearer than any other group or species considered in this paper, yet is widely different even from this. Its large size, long wings, pale grayish-brown color, distinct apical dashes and abdominal tufts should render this a very easily distinguishable species.

Tornos *Morrison.*

1875. Morrison, Proc. Bost. Soc. Nat. Hist., XVII, 217. Type, *scolopacinaria* Gn.
1876. Packard, Monogr. Geom., 214, pl. II, f. 4.
1896. Hulst, Trans. Am. Ent. Soc., XXIII, 351.

Guenée drew up his description of the genus *Lepiodes* (Spec. Gén., X, 359, 1857) from two species of moths, one African and the other American, which apparently were quite similar in structure except that in the male the African species had fasciculed antennæ while the American one had

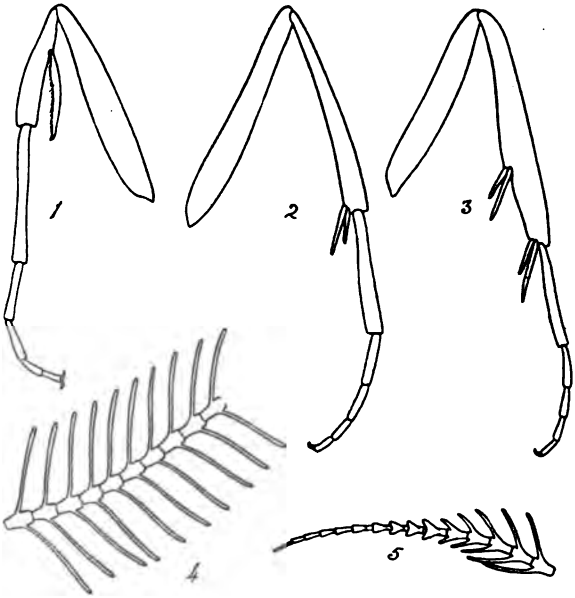

Fig. 12. *Tornos:* 1, 2, 3, fore-, mid-, and hind-leg; 4, section of male antenna; 5, tip of male antenna.

them strongly pectinated. Hulst regarded the differences between the species as of generic value and, as *infectaria*, the Eastern species, is first described under the genus and also the one figured, he limited the name *Lepiodes* to *infectaria* and restored Morrison's name *Tornos* for our species. Marked differences in antennal structure are generally used by Americans as criteria for generic separation, and as a disregard of such differences would lead to the needless fusion of many of our genera, I am following Hulst in regarding *Tornos* as distinct from *Lepiodes*.

Table for the determination of the species of Tornos.

Extradiscal line of primaries absent or represented by a series of dots on the veins *scolopacinaria*.
Extradiscal line of primaries usually well marked, continuous.
  Ground color reddish-brown, cross lines heavy, discal spot large and composed of long erect scales . . . . *cinctaria*.
  Ground color yellow or very pale brown, rarely scattered over with deep brown, cross lines narrow, discal spot 1 mm. or less in diameter, and composed of rather short erect scales.
    Expanse 23–24.5 mm., ground color of ♀ yellow, of ♂ checkered yellow and brown . . . . *erectaria*.
    Expanse 26.5 mm.–32 mm., ground color of both sexes a modest dull yellow or pale brown . . . . *fieldi*.

Tornos scolopacinaria *Guenée.*

1857. Guenée, Spec. Gén., X, 360, *Lepiodes*.
1862. Walker, Cat. Lep. Het. Brit. Mus., XXIV, 1250, *Lepiodes*.
1867. Packard, Mongr. Geom., 565, *Lepiodes*.
1896. Hulst, Trans. Am. Ent. Soc., XXIII, 351, *Tornos*.
1912. Barnes and McDunnough, Psyche, XIX, 16, *early stages*.
robiginosus Morrison.
1875. Morrison, Proc. Bost. Soc. Nat. Hist., XVII, 218, *Tornos*.
1876. Packard, Monogr. Geom., 214, pl. IX, f. 39, *Tornos; 564*, pl. XIII, fs. 3, 3a, *larva*.
1887. Hulst, Ent. Am., III, 11, = *scolopacinaria*.
1895. Hulst, Ent. News, VI, 103, = *scolopacinaria*.
abjectarius Hulst.
1887. Hulst, Ent. Am., II, 192, var. of *Tornos robiginosus*.
1896. Hulst, Trans. Am. Ent. Soc., XXIII, 351, *Tornos; bon. sp*.
1907. Grossbeck, Trans. Am. Ent. Soc., XXXIII, 342, = ♂ *scolopacinaria*.

In describing this species Guenée commented on the dissimilarity in the color of the sexes as did also Morrison in diagnosing *robiginosus*. Packard further spoke of the extreme variability of the form, and said three species could easily be made out of the twelve specimens before him. The third "species," however, would have been based on size and not color. Yet, in spite of all this, Hulst, having evidently only females before him to represent *scolopacinaria*, redescribed the male as a variety of *robiginosus*. Later, in his 'Classification' this variety was accorded specific rank.

The metropolis of the species seems to be in Texas from whence it is constantly being received, but its range extends eastward to Florida, westward to Arizona and northward to Wisconsin (Milwaukee), and Pennsylvania (Harrisburg). It is rare in the northern part of its range and this probably accounts for its larva never having been adequately described.[1] Abbott in his manuscript drawings figures the peculiar tubercled larva on its food plant ("*Coreopsis* [*Primula*] *auriculata* or probably *grandiflora*") together with the pupa and both sexes of the adult, and Packard in his monograph drew up his description of the larva from this figure. As to the habits of the adult we have merely the statement by both Riley[2] and Grote[3] (the latter evidently referring to this species) that the abdomen is raised above the thorax in repose.

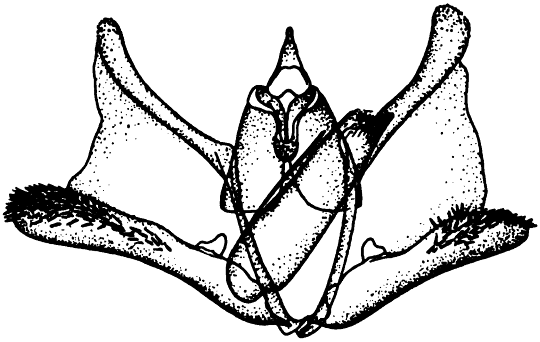

Fig. 13. Genitalia of *Tornos scolopacinaria*.

In Texas the species flies from February 18 (the earliest date I have for its occurrence) continuously to October, unless for some reason it does not occur in September for which month I have no records. From Arkansas I have a specimen labelled as occurring in June; from Missouri it is recorded as occurring on April 19, and from Harrisburg, Pa., on Aug. 21.

Types: Guenée described his species from a male and female specimen in his own collection; Morrison's types, two of each sex, should be in either the Boston Society of Natural History or in the Museum of Comparative

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[1] Barnes and McDunnough (see reference above) have described the larval stages since this paper was written. Food plant: Aster.

[2] Packard, Monogr., 215.

[3] Can. Ent., XV, 24, 1883.

Zoölogy at Cambridge though my notes on the collections in these Institutions make no mention of any being there; Hulst's types are distributed one each in his collection at Rutgers College, in the Brooklyn Institute and in the National Museum: all are males.

Tornos cinctarius *Hulst.*

1887. Hulst, Ent. Am., II, 192, *var. of Tornos robiginosus.*
1904. Dyar, Proc. Ent. Soc. Wash., VI, 225, *Tornos; bon. sp.*
1908. Pearsall, Can. Ent., XL, 133, *Tornos; bon. sp.*

The status of this species has now been well worked out. Like *objectarius* it, too, was originally described as a variety of *robiginosus*, but unlike it was retained as a variety by Hulst in his 'Classification.' Five specimens only are known, four from Florida and one from Georgia. Nothing is known of its habits or of the early stages.

Type: One female in Rutgers College collection. Mr. Pearsall has labelled a male specimen in Mrs. Slosson's collection "♂ type." The specimen was used for the purpose of drawing up a description of the male many years after the original description was published. It is therefore merely a plesiotype.

Tornos erectarius *Grossbeck.*

1909. Grossbeck, Can. Ent., XLI, 155, *Tornos.*

Originally described from five specimens taken in Pinal and Pima Counties, Arizona. The species has not since been taken to my knowledge. The dates for its time of flight range from July 15 to September.

Types: Male and female in the American Museum of Natural History; cotypes in Dr. Wm. Barnes's collection.

Tornos fieldi, new species.

Expanse, 26.5–32 mm. Palpi with mixed yellow and brown scales, front to the antennæ usually entirely dark brown, vertex yellowish. Thorax and abdomen dull yellow, the former marked on the collar and across the posterior part of the patagia with brown, the latter more or less distinctly marked with white and brown at the posterior edge of the segments. Primaries dull yellow or pale dirty-brown sparsely speckled with dark brown atoms. Intradiscal line dark brown, narrow, irregular in its course across the inner fourth of the wing, never entirely complete and sometimes reduced to a few spots. Extradiscal line concolorous with intradiscal, fine, usually contrasting, continuous, and slightly emphasized at the veins. From the costa one-third in from apex, it extends in a broad outward curve to about vein M_1, then turns inward and extends obliquely to the inner margin ending close to the intradiscal line.

Subterminal line fine, whitish, rather evenly denticulate, preceded and succeeded near the costa by a brown shade, and sometimes lost in the ground color near the inner margin. Terminal line dark brown, usually interrupted at the veins. Fringe faintly checkered. Discal spot round, deep brown, conspicuous. Secondaries with ground color paler than primaries except on inner and outer areas. Extradiscal line when present running parallel to outer margin, usually obsolete toward costa. Terminal line brown, continuous. Discal spot oval, much smaller than in primaries. Beneath, very pale dull yellow, sometimes shaded with dusky brown outwardly. Terminal line and discal spots as on upper surface but less pronounced.

Types: Two males and four females received from Mr. Geo. H. Field of San Diego, Cal., after whom the species is named, and three males received from Dr. Barnes. Type male and female in the American Museum of Natural History; cotype with Mr. Field and Dr. Barnes.

Habitat: San Diego, California, June 4, 5, 7, 11, 12, 21, July 3 and Sept. 9.

As indicated in the table this species differs from *erectarius* by its larger size, and the uniformity of tint in the ground color of the sexes. There is a tendency on the part of the female to assume a color slightly yellower than in the male, but this is scarcely apparent as compared with *erectarius*.

Tornos incopriarius described by Hulst in 'Entomologica Americana,' vol. II, p. 210 (1887) and referred by him to *Glaucina* (Trans. Am. Ent. Soc., XXXIII, 352, 1896) has been shown by Pearsall (Can. Ent., XL, 134, 1908) to be identical with the species described as *Æthyctera lineata*.

Exelis *Guenée.*

1857. GUENÉE, Spec. Gén., IX, 323. Type, *pyrolaria* Gn.
1860. WALKER, Cat. Lep. Het. Brit. Mus., XXI, 477.
1896. HULST, Trans. Am. Ent. Soc., XXIII, 351.
Patridava Walker.
1862. WALKER, Cat. Lep. Het. Brit. Mus., XXVI, 1688, *type, tensaria*.
1895. HULST, Ent. News, VI, 103, = *Exelis*.

Exelis pyrolaria *Guenée.*

1857. GUENÉE, Spec. Gén., IX, 324, *Exelis*.
1860. WALKER, Cat. Lep. Het. Brit. Mus., XXI, 477, *Exelis*.
1867. PACKARD, Monogr. Geom., 565, *Exelis*.
tensaria Walker.
1862. WALKER, Cat. Lep. Het. Brit. Mus., XXVI, 1689, *Patridava*.
1895. HULST, Ent. News, VI, 103, = *pyrolaria*.
approximaria Packard.
1876. PACKARD, Monogr. Geom., 215, pl. IX, f. 40, *Tornos*.
1888. HULST, Ent. Am., IV, 50, = *pyrolaria?*

1895. Hulst, Ent. News, VI, 103, = *pyrolaria*.
infumataria Grote.
1877. Grote, Can. Ent., IX, 90, *Tornos*.
1887. Hulst, Ent. Am., III, 11, = *approximaria*.
1895. Hulst, Ent. News, VI, 103, = *pyrolaria*.

The generic characters will serve to separate this species from all others considered in this paper, especially when a female is in hand which is unique in the group in having pectinated antennæ. The close approximation of the median and extradiscal lines of the primaries in the region of the anal vein, a character which led Packard to apply the specific name *approximaria* to the species, will also aid in identifying this form.

The species is evidently not common being included in practically none of the many published local lists of Geometridæ. Grote records it from Texas and Packard from Kentucky. These apparently are the only definite localities published. I can add Kirkwood, Ga., July 6 and 12, and Lakeland, Florida, March 28 and May 5. From Texas I have seen perhaps a dozen specimens, some of which were taken in May. The species probably occurs throughout the Gulf States, and more rarely northward to the Ohio River.

Types: *Pyrolaria* was described from a single male in Boisduval's collection and is probably now with M. Oberthür at Rennes, France; *tensaria* also was described from a male which according to Hulst is in the British Museum; *approximaria* was named from two males and both specimens are in the Museum of Comparative Zoölogy at Cambridge; *infumataria* was apparently named from two females as Grote gives two dates, June 3 and 5; one of the specimens is in the British Museum but the other has not been located.

Exelis ? fumida Warren (Novit. Zool., XI, 581, 1904), described from a single male taken at South Park, Colorado, belongs to none of the groups considered here, but is referable to *Selidosema* as that genus is defined by Hulst. For an examination of this species I am indebted to Dr. K. Jordon of the Tring Museum, England, who through the kind offices of Mr. L. B. Prout, very generously loaned the unique type to me.

Holochroa *Hulst.*

1896. Hulst, Trans. Am. Ent. Soc., XXIII, 352. Type, *dissociarius* **Hulst.**

Holochroa dissociarius *Hulst.*

1887. Hulst, Ent. Am., II, 192, *Tornos.*
1896. Hulst, Trans. Am. Ent. Soc., XXIII, 352, *Holochroa.*

As with *Exelis pyrolaria* this species can be easily told by the strong generic characters. A good specific character however is found in the extradiscal line which beginning far out on the costa near the apex curves inwardly to a point on vein M_1 near outer margin and then forming a very acute angle runs wavedly to far in on inner margin. In this regard it slightly approaches *Morina coniferaria.* It was described from a single male specimen, and no locality was given. The type at New Brunswick bears a California label. I have been able to identify three specimens from the Barnes collection with the species, a male from White Mountains, Arizona, and two females taken at Glenwood Springs, Colorado, July 1-7 and 24-30.

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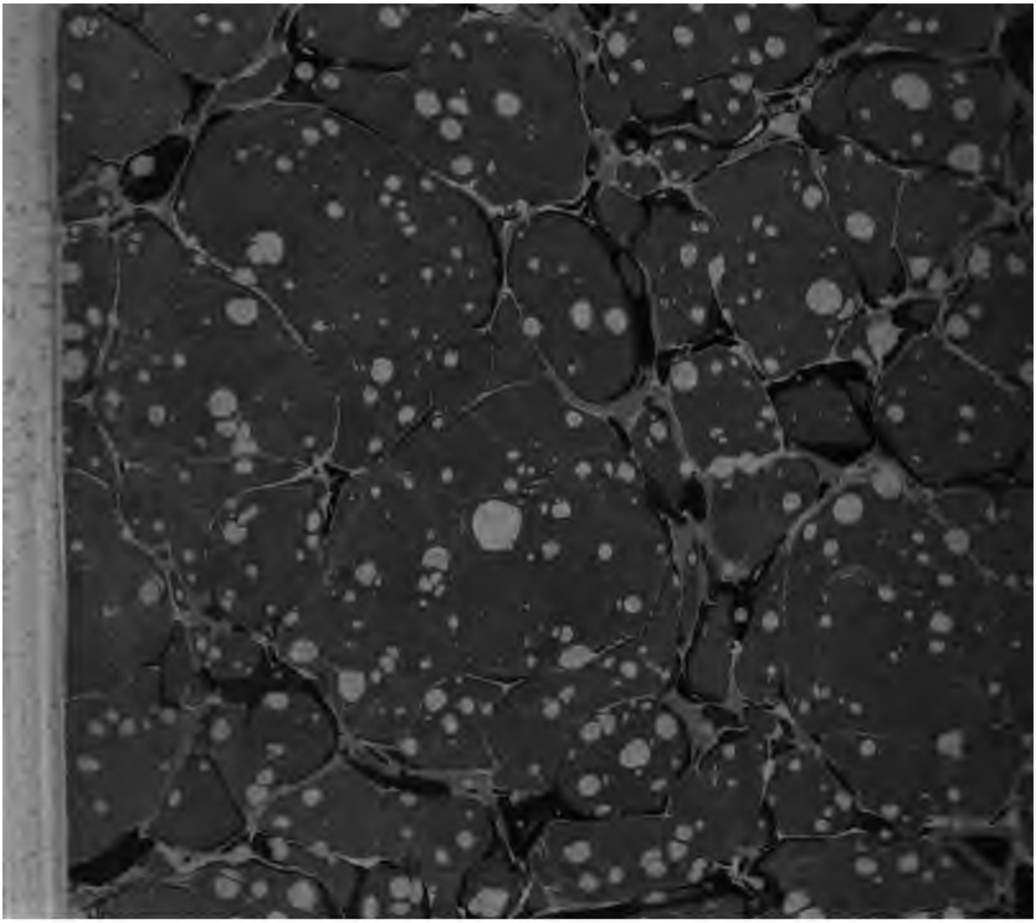

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